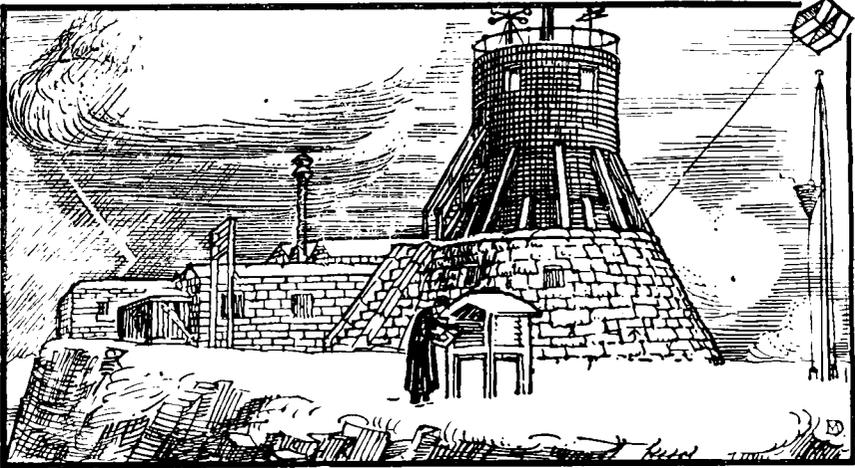


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METEOROLOGICAL MAGAZINE



•••• EDITED BY HUGH ROBERT MILL ••••



1904.

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The sternness of the external aspect of this Magazine is said to have had a repellent effect on chance readers, and with the commencement of the Fortieth volume it has been decided to remove that reproach from the cover, in the hope, however, that it will not be transferred to the contents. The central part of the design is the restoration of a building suggestive by its appearance, its purpose, and its fate, of the Tower of the Winds at Athens

DESIGN FOR COVER, DRAWN BY M. J. DAWSON.

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Edited by HUGH ROBERT MILL, D.Sc., LL.D.

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Symons's Meteorological Magazine.

No. 457.

FEBRUARY.

Vol. XXXIX.

OUR NEW VOLUME.

WITH this number commences the thirty-ninth volume of *Symons's Meteorological Magazine*, and the fourth under its present editorship. It has been our aim to maintain the interest and utility of the Magazine, though when we turn back to the earlier volumes, when each issue rang with the clash of arms of eager controversialists, we feel that the interest has often been allowed to flag. Such a state of things is not as it should be, and we trust that we are not in error in our belief that the twentieth century is about to witness a rapid advance in meteorological science. By the early reports of the meetings of the Royal Meteorological Society, the Scottish Meteorological Society, and the Cosmical Physics Section of the British Association, our readers are kept aware of all that is passing in the meteorological life of these islands, and it is only want of space, not want of will on our part, that prevents the survey from being world-wide. This year we propose, though we do not promise, to maintain the size of the magazine at twenty pages, and we have several articles of special interest in contemplation, as to which it will be safer to abstain from prediction until the promises on which we depend are in course of fulfilment.

The increase in the attention bestowed on matters meteorological during the recent heavy rains promises to lead to permanent results by increasing the number of observers, and it has had a marked effect in accelerating the promptitude with which the returns for *British Rainfall* have come in. It has long been characteristic of the British Rainfall Organization that all classes worked together to advance this little corner of science without distinction of person. It would be difficult to say off-hand whether Clergymen, Doctors, Engineers, Farmers, or Gardeners (the order is alphabetical) are doing most, but all are doing much. The Prime Minister has expressly authorised his gardener at Whittingehame to send in returns of rainfall, and many members of both Houses of Parliament take a practical interest in the work.

His Majesty the King has recently honoured the Rainfall Organization by accepting with a gracious message of thanks a copy of the

various publications, and he has been pleased to direct that returns from the rain gauges in all the Royal Gardens shall be sent in regularly for insertion in *British Rainfall*. The record from Windsor has long graced the pages; those from Sandringham and Balmoral will appear in the new volume of *British Rainfall*, and that at Buckingham Palace will fill up a gap in the rain returns of London.

Pleasing as it is to be encouraged by the countenance of those in the highest places, we do not forget that one of our most faithful and valued correspondents is a railway porter, observing not by the orders of his superiors but out of love for the work, and that many others earn their bread by the hardest toil. Our hope is to do the best we can in discussing the records with which all the observers entrust us.



ATMOSPHERIC PRESSURE AS A FACTOR OF CLIMATE.

BY L. BONACINA.

It is only by treating meteorological phenomena as the product of so many climatic factors that we are enabled to afford a satisfactory explanation of the atmospheric conditions of any portion of the Earth's surface.

We propose in this article to resolve climate, a term which we may define to be the average state of the weather over a given area, into its constituent factors, so that if from some remote or little-known land sufficient geographical data were received, we should be able to synthesize, as it were, its theoretical climate, which would bear a very close resemblance to its actual one. By adopting such a method of analysis, the fact, for instance, that the mean annual temperature of London is 49° F. becomes vested with a real interest;* for if we knew nothing about the climate of London we could from the possession of certain geographical and geological data relating to the city, infer that the climatic conditions were those of the colder portion of the temperate zone with an approximate mean annual temperature of 50° F.

The chief factors which are involved in the formation of the climate of any locality may be classified as follows:—(a) latitude of the locality, (b) its altitude, (c) physical features, that is whether it is composed of land or water, whether it is an arid desert or covered with vegetation, (d) proximity to the sea, to ocean currents, to mountain ranges, etc., (e) geological formation, (f) the average distribution of pressure as indicated by the configuration of the

* The results of a long series of observations taken at the Royal Observatory, Greenwich, fix the mean annual temperature at 49°·2 F. The more central London stations give a value a degree or two higher. When we reflect upon the enormous extent to which the processes of combustion and respiration take place within the metropolitan area, we need not be surprised at the apparent discrepancy. [The mean of the 9 a.m., 9 p.m., max., and min. temperatures for 45 years at Camden Square is 49°·8.—*Ed. S.M.M.*]

isobars. These factors, of course, interact with one another in the most complex manner in their resultant effect, and it is frequently very difficult to judge to what extent a particular type of weather may be due to the operation of any one of them.

With regard to the relative significance of the climatic factors we may say that in the tropics latitude and altitude play the most important part, but that in the temperate zones the influence of isobars is nearly as great, and sometimes altogether masks the effects of latitude. In the case of the British Isles, the average configuration of the isobars has a most pronounced effect. Thus, were the normal distribution of pressure over Britain anti-cyclonic instead of cyclonic, the influence of a northern latitude would be strongly felt, and the winters would be incomparably severer than they are.*

The mildness of the climate of the British Isles compared with that of many other countries between the same parallels of latitude is frequently attributed to the fact that their western shores are bathed by a body of warm water known as the Gulf Stream. We admit this reservedly. The power of the Gulf Stream to raise the temperature of the air in England is entirely dependent upon the prevailing distribution of atmospheric pressure. Pressure is normally low, especially in winter, in the neighbourhood of Iceland; a gradient for westerly or south-westerly winds across Great Britain is thus set up, and in this way the modifying influence of the Gulf Stream becomes apparent. That the direct influence of the Gulf Stream is imperceptible during the persistence of anti-cyclones is proved by the fact that when anticyclonic conditions of similar intensity dominate the weather over the British Isles, frosts are developed in the most central parts of Ireland almost equal in severity to those experienced in the most central parts of England and Scotland.† Moreover, the warming influence of the Atlantic Ocean is probably inappreciable on those occasions when a cyclonic disturbance traverses these islands in an easterly direction. Depressions move rapidly, continually affecting fresh masses of air, and only their southern outskirts would be fed by air from the Atlantic.

We have here, however, to take special cognizance of the fact that the mean annual temperature of Britain is raised at least 10° F. by the prevailing south-westerly winds, which, blowing as they frequently do from a great distance, doubtless receive an additional store of thermal energy from the warm waters of the Gulf Stream. We have now to observe that, though the configuration of the isobars

* The mean January temperature at Greenwich would be about 20° F., instead of 37° F. as it now is.

† In February, 1895, the minima in the screen were 6° at Parsonstown, 7° at Greenwich and -5° at Loughboro' in Leicestershire. In February, 1902, the respective minima were 13°, 14°, and 8°. In January, 1881, they were 6°, 8°, and 2°. Presuming that anti-cyclonic conditions of equal intensity prevailed all over the British Isles, we see that the recorded temperatures show no relation to proximity to any body of warm water off the western coast, but merely to distance from the sea.

deserves to be ranked as one of the most important factors of the climate of western Europe generally, in some parts of the world the formation of isobaric systems appears, on the contrary, to be a function of climate. Thus the persistent winter anti-cyclones of Canada and Siberia may be safely attributed to the intense cold which in those countries reigns supreme for a longer or shorter period of the year. The increase of pressure thus occasioned by the great cold will in turn promote a further reduction of temperature by permitting terrestrial radiation to take place more freely. We see then in what an intricate manner temperature and pressure may react upon one another. Even in the British Isles, where cyclones and anti-cyclones are merely accidents, as it were, in the general circulation of the atmosphere we may frequently notice this interaction of pressure and temperature. If anti-cyclonic conditions should happen to set in at a time when the country is covered with snow they will persist much longer than, *ceteris paribus*, they otherwise would do, in accordance with the principle that masses of snow produce a further diminution of temperature, and consequent increase of pressure. Doubtless the great frost of 1895 was protracted in this way.

With regard to the mutual relationship between low pressures and temperature, we are perfectly justified in asserting that the convection theory of cyclones, which ascribes their origin to the ascent of masses of heated air, will not account for those of north-western Europe. There are, on the contrary, good reasons for believing that the rapid variations of temperature associated with the passage of winter cyclones are the product, not the cause of cyclone action. We are not at present concerned with the complex problems relating to the distribution and variations of temperature in cyclones; suffice it to say that the convection theory, in so far as it appertains to British cyclones, is totally disproved by the well-ascertained facts that the ascending current in a cyclone is frequently colder than the descending current in the adjacent anti-cyclone, and that atmospheric disturbances are most frequent and violent during the cold months of the year. We must, nevertheless, not forget that if there should happen to be an unstable temperature gradient, that is to say, if the air ascending in the centre of the cyclone should possess a higher temperature than the surrounding air, the system will develop increased energy.* It will be obvious, then, that a constant succession of cyclones must constitute an important factor of climate in a country where such disturbances are not initiated by local variations of temperature.

With regard to the origin of cyclones, we can only say that they are the product of the general circulation of the atmosphere, just as the countless eddies which indent the surface of a river originate in

* Thunderstorms are, no doubt, due to the sudden uprush of warm, moist air, resulting in rapid condensation of vapour and increase of electrical potential.

the forward motion of the water itself. Until, however, something more is known of the complex laws which regulate the phenomena of fluids in motion, any speculation as to the conditions requisite for the production of an atmospheric cyclone can amount to no more than a surmise.

Although the sun's rays are required to set the atmosphere in motion by exciting differences of temperature, the actual distribution of pressure over the surface of the globe is rendered extremely complex by the Earth's axial rotation, together with the unknown laws which control the movements of a circulating fluid, so that while all cyclones and anti-cyclones are ultimately traceable to the great thermal slope from the equator to the poles, they in turn react to a greater or less extent upon climate, constituting an important factor in the relative distribution of temperature, wind and rainfall.



THE CLIMATE OF THE BRITISH EMPIRE DURING 1902.

THIS summary should properly have appeared in the previous volume, but although belated, we feel that it should not be excluded. Considerable additions to the list of stations comprised in the climatological tables for the British Empire, have been made during the year 1902, but it is hardly necessary to remind our readers that it is still very far from being fully representative of all the varying climates of the Empire.

Of the new stations Madras is perhaps the most remarkable, since it provides the highest mean annual temperature that has ever been recorded in these tables. Coolgardie also immediately makes an appearance in the summary of extremes, with the very high mean daily range of $25^{\circ}\cdot5$, thus taking the place of Winnipeg, which has provided this item uninterruptedly for 16 years, though it must be noted that Coolgardie owes its great range to high maxima, whereas Winnipeg owed it to low minima. The mean temperature at Winnipeg, for 1902, is the highest since 1879, and although the minimum reached $-36^{\circ}\cdot1$, it has seldom been so high in former years. The returns from the arctic station at Dawson were again unfortunately incomplete, but it is worthy of note that the minima of the four months, January, February, November and December, were respectively $-50^{\circ}\cdot0$, $-49^{\circ}\cdot0$, $-48^{\circ}\cdot0$, and $-51^{\circ}\cdot0$, while in December the mean maximum was $-16^{\circ}\cdot7$, and the mean minimum $-28^{\circ}\cdot2$. The rainfall was greatest, as usual, at Colombo, where the fall was heavier, with one slight exception, than in any year since 1878.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1902.

STATIONS.	ABSOLUTE.		AVERAGE.				ABSOLUTE.		TOTAL RAIN.		AVER- AGE. Cloud.			
	Temp.	Date.	Temp.	Minimum.	Date.	Max.	Min.	Mean.	Dew Point.	Humidity.		Max. in Sun.	Min. on Grass.	Depth.	Days.
<i>Those in Italics are South of the Equator.</i>														
London	85.1	July 15	15.8	February 16	57.4	42.9	50.1	43.5	79	132.1	14.3	20.84	162	6.6
Malta	99.7	July 25	40.4	February 17	72.5	59.3	65.9	56.3	76	148.3	34.1	24.84	66	3.3
Lagos, W. Africa.	95.1	April 13	66.1	December 29	86.4	75.7	81.1	74.7	79	148.0	...	45.94	70	...
Cape Town	98.9	March 20	38.3	August 18	70.6	54.4	62.5	53.0	72	...	...	33.74	122	4.6
Durban	105.6	September 23	47.4	June 14	79.2	61.0	70.1	...	...	156.1	...	41.18	160	4.6
Mauritius	89.9	November 20	51.9	August 12	81.8	68.0	74.9	65.6	75	159.2	44.8	47.11	184	5.7
Calcutta*	...	.....	...	.....	...	...	...	...	...	...	...	...	...	...
Bombay	94.9	June 3	64.1	February 7	87.4	76.6	82.0	72.9	75	143.5	41.1	62.28	83	4.5
Madras	108.0	May 8	62.2	February 6	91.0	75.4	83.2	72.0	76	153.0	58.2	54.44	104	4.6
Kodaikanal	75.2	March 23 May 7	39.4	January 26	64.7	51.3	58.0	...	75	145.3	27.2	72.53	184	5.3
Colombo, Ceylon	93.4	March 5	65.2	January 24	87.3	75.5	81.4	73.3	80	158.0	61.3	117.01	198	5.8
Hongkong	92.2	July 27	40.5	February 4	78.2	69.6	73.9	65.3	76	150.6	...	97.52	136	6.3
Melbourne	103.0	January 31	29.6	August 14	67.0	49.1	58.0	47.3	71	161.7	21.3	23.08	102	6.0
Adelaide	111.4	February 11	36.9	(June 26 July 9, 10	73.7	53.1	63.4	47.3	59	167.9	30.9	16.02	124	4.8
Coolgardie	108.6	December 20	31.9	July 30	77.9	52.4	65.1	...	...	...	24.0	14.69	51	3.5
Sydney	100.0	December 24	40.3	August 1	69.7	56.5	63.1	...	73	151.2	31.8	43.07	176	4.8
Wellington	81.0	January 13	32.0	July 17	60.6	47.8	54.2	44.5	71	136.0	24.0	38.75	201	5.8
Auckland	79.5	March 1	38.5	July 17	63.1	51.7	57.4	46.6	67	144.0	33.0	38.28	184	5.1
Jamaica, Negril Pnt.	...	.....	...	.....	...	...	...	...	78	...	...	50.78	123	...
Trinidad	97.0	December 1	61.0	January 5	87.6	69.6	78.6	73.4	82	177.0	58.0	55.34	139	...
Grenada	90.8	May 18	68.4	June 30	83.4	74.1	78.8	70.5	74	160.0	...	70.86	226	2.9
Toronto	91.0	July 8	-3.3	December 9	54.2	37.4	45.8	39.6	78	107.8	-10.2	31.04	155	6.3
Fredericton, N.B.	84.7	June 2	-22.0	February 12	52.0	20.6	41.7	30.8	60	...	...	49.66	147	5.9
Winnipeg	91.2	August 5	-36.1	January 27	48.6	26.6	37.6	...	...	...	...	20.22	98	5.7
Victoria, B.C.	86.2	July 19	12.3	January 25	55.9	44.5	50.2	...	...	...	...	26.45	151	6.5

* Thermometer shed under repair February 11th-20th.

SUMMARY.

<i>Highest Temp. in Shade</i>	111°·4 at Adelaide on February 11th.
<i>Lowest</i> " "	—36°·1 at Winnipeg on January 27th.
<i>Greatest Range in year</i>	127°·3 at Winnipeg.
<i>Least</i> " "	22°·4 at Grenada.
<i>Greatest Mean Daily Range</i> ...	25°·5 at Coolgardie.
<i>Least</i> " "	8°·6 at Hongkong.
<i>Highest Mean Temp.</i>	83°·2 at Madras.
<i>Lowest</i> " "	37°·6 at Winnipeg.
<i>Driest Station</i>	Adelaide, mean humidity, 59.
<i>Dampest</i> "	Trinidad " " 82.
<i>Highest Temp. in Sun</i>	177°·0 at Trinidad.
<i>Lowest Temp. on Grass*</i>	—10°·2 at Toronto.
<i>Greatest Rainfall</i>	117·01 in. at Colombo, Ceylon.
<i>Least</i> "	14·69 in. at Coolgardie.
<i>Most Cloud</i> ..	6·6 at London.
<i>Least</i> " ..	2·9 at Grenada.

 Correspondence.

To the Editor of Symons's Meteorological Magazine.

 BELVILLE'S JOURNALS.

I HAVE been considering the point raised by you in your editorial note last month, with reference to the rainfall of 1824, and I am still of the opinion that the record was made at the Royal Observatory. I am aware that Mr. Eaton, in his account of Belville's Journals, given in his paper on "The Mean Temperature of the Air at Greenwich" ("Quarterly Journal, Royal Meteorological Society," vol. xiv., January, 1888), inclines to the belief that the entries in the Royal Observatory M.S. Journal, from 1822 to 1826, are transcripts of Belville's observations at Park Row and Park Terrace. But it would appear that Belville on changing his residence in 1822 did not remove the rain gauge from the Observatory, and it continued in use there until 1878, and is now in the Observatory Museum. The rain table cited by you was drawn up many years ago by Mr. Glaisher, and all the values in the early years (prior to 1841) were raised in the proportion of ten to eleven, under a mistaken notion with regard to the position of the gauge.

W. C. NASH.

Blackheath, 9th February, 1904.

* The minimum on grass is not recorded at the other Canadian stations. In every case the extreme conditions refer only to the stations quoted in the Climatological Table. It is quite possible that other places in the empire were hotter, colder, wetter or drier, than any here cited.

THE STUDY OF SUNSPOT CYCLES.

The method suggested by Mr. J. Edmund Clark, in Vol. **38**, p. 136, for arranging the years in order to obtain meteorological means conforming to the sunspot cycle, seems to me a useful one. However, the years of maxima given by him do not conform in many cases with the years recently given by Wolfer in the revision of the relative sunspot numbers. (See the *Astronomische Mittheilungen*, vol. **93**, and the *United States Monthly Weather Review* for April, 1902).

Also, there seems to me more joining of two years in one in the scheme of Mr. Clark than is necessary. Hence I have arranged the years in the following manner. In this scheme the years of maxima and minima all conform with the dates given by Wolfer, except the maximum of 1804. In this case there was a prolonged maximum, extending from 1802—1805, and it seems to me the maximum more properly belongs in 1804 rather than in 1805, as given by Wolfer.

A Plan for Reduction of Years to Mean Sunspot Curve.

CYCLE.	Min.											Max.	Wolfer's Maxima.
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.		
1745'0—1750'3...	45	6	7	8	9	50	1	2	2-3	3	4	1750'3	
1755'2—1766'5...	55	6	7-8	9	0	61	2	3	3-4	4	5	1761'5	
1766'5—1775'5 ..	66	7	7	8	8	69	0	1	2	3	4	1769'7	
1775'5—1784'7...	75	6	6	7	7	78	9	0	1	2	3	1778'4	
1784'7—1798'3...	84	5	6	6	7	88	9	0-1	2-4	5-6	7	1788'1	
1798'3—1810'6...	98	9	0	1-2	3	04	5	6	7	8	9	1805'2	
1810'6—1823'3...	10	1	2-3	4	5	16	7	8	9-0	1	2	1816'4	
1823'3—1833'9...	23	4	5-6	7	8	29	0	1	1	2	2	1829'9	
1833'9—1843'5...	33	4	5	5	6	37	8	9	0	1	2	1837'2	
1843'5—1856'0...	43	4	5	6	7	48	9	0	1-2	3	4	1848'1	
1856'0—1867'2...	55	6	7	8	9	60	1	2	3-4	5	6	1860'1	
1867'2—1878'9..	67	8	8	9	9	70	1	2-3	4	5-6	7	1870'6	
1878'9—1889'6...	78	9	0	1	2	83	4	5	6	7	8	1883'9	
1889'6—1901'5 ..	89	0	1	2	3	94	5	6	7-8	9	0	1894'1	

HENRY HELM CLAYTON.

Hyde Park, Mass., U.S.A., Jan. 24, 1904.

SQUALLS OF JANUARY 13th-14th.

I should like to know whether what I observed here on Wednesday, January 13th, was observed by other readers of this Magazine. Between 9.30 and 10 p.m. there were three flashes of lightning seen over the Channel. At 11.30 p.m. a squall came over here, wind being W. to S.W., accompanied with hail, thunder and lightning, lasting about ten minutes.

Then at 2.30 a.m. on Thursday morning the same occurrence was witnessed, the lightning lasting longer. At 5.30 a.m. there was another squall of a like nature, the lightning lasting longer than the other two.

What I think is curious is that they all commenced at the half hours. All the squalls had hail, which on making its first appear-

ance was accompanied by a bright flash of lightning and a loud clap of thunder. My recording barometer went down to 29·06 inches at 5.30 and was wavy from 2 to 6 o'clock.

HENRY NEWBY.

32, Magdalen Road, St. Leonards-on-Sea, Jan. 14th, 1904.

[Many correspondents refer to the thunderstorms of January 13th—14th, which were general over the south of England. At least one of the squalls referred to in the above letter was of exceptional severity, as is shown by the following extract from *The Times* of January 15th :—

“ A severe gale broke over Brighton and Hove in the early hours of yesterday morning. At 2 p.m.* a squall swept over the towns, doing considerable damage. A number of chimney stacks were blown down, and some of the streets were strewn with slates. A lady had a wonderful escape at the Princes Hotel, Hove. A stack of five chimneys fell from a height of about 50 ft. upon the roof of the hotel on the west side. The roof gave way, and the lady, who occupied a bedroom beneath, was almost buried in the wreckage. The building was very strongly constructed, and one of the beams supporting the roof, falling crosswise into the room, helped to prop up the sheets of lead flung down from the roof, and thus a kind of protective canopy was formed over the bed, and to this the occupant owed her life, though she sustained a severe wound. A bell was close to her, but she was unable to reach it, and had to lie exposed to the fury of the storm until 7 o'clock, when she was rescued.”

It is an interesting fact that the Redier barograph at Camden Square recorded a sudden fall of ·025 inch and an almost immediate recovery at 2.30 a.m., the period of this abrupt reduction of pressure being so short that the downward and upward movement of the pencil showed only a single line, and did not interfere with the steady fall of the barometer which was in progress at the time.]—ED. *S.M.M.*

METEOROLOGICAL NEWS AND NOTES.

THE HEAVY RAINFALL OF 1903 will not soon be forgotten. It has made for itself a place in literature, and a correspondent recalls to our attention that the pluviometric conditions are thus enshrined in the felicitous dog Latin of the Westminster School Play :—

“ *Totum annum pluvit felibus et canibus.*”

MR. WILLIAM S. BRUCE, of the Scottish National Antarctic Expedition, has offered to hand over Omond House and Copeland Observatory, in the South Orkneys, to the Argentine Meteorological Office, and to give four scientific men chosen by them a free passage and eighteen months' provisions, if they will undertake to continue during the next year the meteorological and magnetical work which the Scottish Expedition has initiated and carried on during the past year. We have reason to believe that this offer will be accepted and that Mr. R. C. Mossman, Meteorologist to the Scottish Expedition,

* This is obviously a misprint for 2 a.m.—ED. *S.M.M.*

will remain in charge of the station. The Scottish Expedition hoped to continue meteorological and other research to the south-east of the South Orkneys during the present season. A labour strike in Buenos Aires has, however, seriously impeded the refitting of the "Scotia," and the summer has already almost passed.

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on Wednesday, January 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

The Council in their Report congratulated the Society on the steady increase in the number of Fellows. The Symons Gold Medal had been awarded to Hofrath Dr. Julius Hann, of Vienna, in consideration of his eminent services to the science of Meteorology. The Society's Howard Silver Medal, annually awarded to the cadets of "H.M.S. Worcester," had been gained by Cadet H. Wormell for his essay on "The use of Clouds in forecasting the Weather." A new section had been added to the *Quarterly Journal*, entitled "Meteorological Literature," which gives the titles of such papers as appear to be of general interest, bearing on Meteorology, in the periodicals which are received in the Society's Library. The Council also referred to the Kite Observations carried out by Mr. Dines during the past summer on the west coast of Scotland, which had been made under very unfavourable conditions as regards both the weather and the vessel which had to be employed.

The Report having been adopted and the usual votes of thanks passed, the President read from the Council minutes a statement of Dr. Julius Hann's services to Meteorology, and then with a few appropriate words handed the Symons Gold Medal to Count L. Széchenyi, First Secretary to the Austro Hungarian Embassy, who was present to receive it on behalf of Dr. Hann.

The President then delivered an address on "The Present Condition of Ocean Meteorology." He said that he had chosen that subject because he believed that the solution of many weather problems must be sought in close study of atmospheric conditions over oceanic areas. He referred to the early workers in meteorological science, Captain Maury in America and Admiral FitzRoy in this country, and also to the addresses on the subject delivered to the Society some years ago by Dr. R. H. Scott. The President then sketched the present state of our knowledge, illustrating his remarks by numerous slides of isobaric, isothermal and other maps of the various oceans drawn on Flamsteed's projection. He reviewed the meteorological work of different nations, pointing out the energetic action of the United States in particular, and also of Germany and Great Britain. He was of opinion that we had reached the limits to which it was possible for us to go in weather forecasting with the

meteorological knowledge at present within our reach. What was now required was a liberal infusion of scientific imagination into our methods. It was to be hoped that a meteorological Darwin might appear, to set us once for all in the path for which we were groping. In conclusion, he regretted the want of liberality shown by the Government in affording financial aid for the development of this important science; and he urged the necessity of interesting the youth of the country in the matter, by making it a special subject of the curriculum in schools and colleges.

A vote of thanks having been passed to the President for his address, the scrutineers of the ballot announced that the following gentlemen had been elected the Officers and Council for the ensuing year :—

President—Captain D. Wilson-Barker. *Vice-Presidents*—Mr. W. H. Dines, Mr. J. Hopkinson, Mr. H. Mellish, and Dr. W. N. Shaw, F.R.S. *Treasurer*—Dr. C. Theodore Williams. *Secretaries*—Mr. F. Campbell Bayard and Dr. H. R. Mill. *Foreign Secretary*—Dr. R. H. Scott, F.R.S. *Council*—Mr. R. Bentley, Mr. J. Y. Buchanan, F.R.S., Capt. W. F. Caborne, C.B., Mr. R. H. Curtis, Dr. H. N. Dickson, Mr. F. Druce, Sir J. Eliot, F.R.S., Mr. W. Ellis, F.R.S., Capt. M. W. C. Hepworth, C.B., Mr. R. Inwards, Mr. Baldwin Latham, and Mr. E. Mawley.

The Annual General Meeting was preceded by a brief Ordinary Meeting, at which the following gentlemen were elected Fellows :—Mr C. Beadle, Mr. H. Garnett, Mr. C. W. Nicholl, and Mr. W. I. Walker.

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BEN NEVIS OBSERVATIONS AND WEATHER FORECASTS.

By the courtesy of Dr. A. Buchan, F.R.S., we have been favoured with a copy of the Report of the Committee on Meteorological Observations on Ben Nevis, presented to the British Association at the Southport meeting in 1903.

It contains the following interesting statement of the views of the Director of the Observatory as to the possibility of utilizing the observations for the purpose of weather forecasts :—

Some of the results have a special bearing on forecasting. One or two illustrative cases may be here added.

1. The occurrence of small differences of temperature between Ben Nevis and Fort William, associated with very low humidities at Ben Nevis and great dampness at Fort William, and the relations of this state of things to the stability and continuance of an anticyclone, and also to thunderstorms and those heavy local rains commonly denoted as thunder showers, have been reported on.

2. The occurrence of long-continued periods of saturation of the air at the top of Ben Nevis, as indicative of a condition of the atmosphere favourable to the development and continuance of stormy weather.

3. A marked difference in the *direction* of the wind on the summit from that at surrounding low-level stations. Such a difference most commonly occurs when Ben Nevis lies between a cyclone and an anticyclone, and may be

indicative of the direction of movement either of the cyclone or the anti-cyclone.

4. The predictive aspects of *very strong* winds on the summit of Ben Nevis accompanied, notwithstanding their great force, with very low temperatures there and great differences of temperature between the summit and Fort William, and the intimate connection of the whole with cyclonic weather, have been pointed out. Recent kite observations have made us tolerably familiar with this remarkable phase of the cyclone, and to Ben Nevis we may look for important contributions of illustrative data.

5. The difference between the Ben Nevis and Fort William barometers when both are reduced to sea-level. This difference, when it amounts to several hundredths of an inch, clearly points to an abnormal condition of the air between the summit and Fort William in respect to the vertical gradient of temperature or humidity, or both.

The investigation of some of the points raised in this discussion has been a chief subject of inquiry during the past eighteen months. The inquiry is a discussion of the hourly observations of pressure, temperature, humidity, sunshine, winds and rainfall at the two Observatories in their inter-relations, more especially as regards the bearings of the results on weather changes.

The principal point to be kept in view is the relation of the differences of temperature at the two Observatories to the differences of their sea-level pressure at the time. An illustration will explain this. During the last three days of September, 1895, the sky over Scotland was clear, sunshine strong, humidity high, night temperatures unusually high, and dews heavy, with calms or light winds. On these days while at the top temperature was very high and the air clear and very dry, at Fort William, under a sky equally clear and temperature high, the air showed a large humidity, and this state of moisture extended to a height of about 2,000 feet, or nearly halfway to the summit. Thus, then, while the barometer at the top was under an atmosphere wholly anticyclonic, with its accompanying dry dense air, the barometer at Fort William was not so circumstanced. On the other hand, it was under the pressure of such dry dense air, above the height of 2,000 feet only, whereas from this height down to sea-level it was under the pressure of air whose humidity was large and pressure therefore much reduced. The result was that the sea-level pressure at Fort William was 0.050 inch lower than it would have been if the dry dense air of the anticyclone had been continued down to Fort William. This is confirmatory of what is to be expected, that the greater density of dry air as shown in our laboratories prevails equally in the free atmosphere.

The first part of the discussion is virtually finished, the chief result of which is this:—1. When the differences of mean temperature of the day is only $12^{\circ}0$ or less, then the sea-level pressure calculated for the top of the mountain is markedly greater than at Fort William. 2. When the difference of temperature is $18^{\circ}0$ or greater, then the sea-level pressure for the summit is markedly lower than at Fort William. In the former case the meteorological conditions are anticyclonic, the weather being then clear, dry, and practically rainless; and in the latter case the conditions are cyclonic, the accompanying weather being dull, humid, and rainy. In the course of this discussion it has been marked that the reduced hourly values from day to day often indicate that the transition from the anticyclonic to the cyclonic type of weather, and *vice*

versa, is slow, sometimes extending over several days, thus prolonging the time for the prediction of the more important weather changes.

It may be remarked that the result here empirically arrived at is in accordance with the principle laid down by Dalton, that 'air charged with vapour or vaporised air is specifically lighter than when without the vapour; or in other words, the more vapour any given quantity of atmospheric air has in it, the less is its specific gravity.'

The precursor and accompaniment of the heaviest and most widespread rains is when the sea-level pressure for the summit is very greatly lower than the sea-level pressure at Fort William. This indicates the saturation of the atmosphere to a great height, while at Fort William, and, say, 2,000 feet higher, the point of saturation due to the advancing cyclone has not yet taken place.

On the other hand, when this point of saturation has been reached, then the sea-level pressure for the summit shows less difference from the sea-level pressure at Fort William. The changes of pressure which occur at the two Observatories as a cyclone advances and passes on are particularly interesting and instructive.

It is remarkable that comparatively few observations, when the difference of the temperature has exceeded $22^{\circ}\cdot 0$, could be utilised in this inquiry, because in such cases high winds prevailed, resulting in 'pumping' of the barometer. These differences of temperature, rising even to $27^{\circ}\cdot 0$, are however extremely valuable for weather prediction, inasmuch as they often precede and accompany very severe storms of wind and rain. They arise from an extraordinary lowering of the temperature at the summit while at Fort William no such lowering of temperature occurs. This is a peculiarity which kites and balloon ascents have recently familiarised us with, and it forms a prime factor in all inquiries into the theory of the cyclone, about which opinion at present is so much divided.

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### RAINFALL ON THE RIVER BANN, CO. DOWN, AT BANBRIDGE AND LOUGH ISLAND REAVY RESER- VOIR FOR 40 YEARS FROM 1862 TO 1901.

BY JOHN SMYTH, M.A., M.Inst.C.E.I.

(Concluded.)

THE Tables of monthly rainfall, published in the number of this Magazine for December last, will be brought up to the end of 1903 by the following additions.—

| STATION.                  | October.<br>ins. | November.<br>ins. | December<br>ins. | TOTAL |
|---------------------------|------------------|-------------------|------------------|-------|
| Milltown, Banbridge ..... | 4·6              | 2·1               | 2·3              | 38·4  |
| Bann Reservoir .....      | 8·5              | 2·2               | 6·7              | 60·1  |

The greatest ten-year average at Bann Reservoir, Lough Island Reavy, is 49·05 from 1894 to 1903, which exceeds the greatest ten-year average in the 40 years, 1862-1901. Although the ten months' rainfall ending November 30th, 1903, is the greatest on record, yet the year's rainfall at Lough Island Reavy was less than that of 1872.

Some interest attaches to the monthly aggregates of rainfall in each year, and these are accordingly added.

Summary of Rainfall at Milltown, Banbridge, co. Down.

| YEAR.               | Jan. | First 2 mos. | First 3 mos. | First 4 mos. | First 5 mos. | First 6 mos. | First 7 mos. | First 8 mos. | First 9 mos. | First 10 mos. | First 11 mos. | 12 mos |
|---------------------|------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|--------|
|                     | in.  | in.          | in.          | in.          | in.          | in.          | in.          | in.          | in.          | in.           | in.           | in.    |
| 1862.....           | 3·6  | 4·6          | 7·3          | 10·1         | 13·9         | 16·7         | 20·2         | 22·0         | 23·9         | 27·5          | 30·1          | 33·2   |
| 1863.....           | 3·1  | 3·9          | 5·6          | 6·9          | 9·4          | 12·1         | 12·9         | 16·7         | 19·7         | 25·3          | 27·6          | 29·4   |
| 1864.....           | 1·4  | 2·6          | 4·6          | 6·7          | 8·5          | 11·1         | 12·4         | 14·8         | 17·3         | 19·7          | 23·2          | 25·2   |
| 1865.....           | 2·7  | 5·4          | 7·6          | 8·2          | 12·4         | 12·9         | 14·4         | 17·1         | 17·4         | 23·4          | 26·9          | 29·1   |
| 1866.....           | 3·5  | 5·8          | 8·3          | 9·8          | 10·7         | 12·8         | 14·9         | 17·6         | 21·1         | 23·1          | 25·4          | 28·1   |
| 1867.....           | 3·7  | 5·4          | 7·4          | 11·2         | 14·1         | 15·1         | 21·5         | 23·5         | 25·2         | 29·5          | 30·3          | 31·9   |
| 1868.....           | 2·5  | 4·7          | 7·6          | 9·7          | 12·0         | 12·7         | 13·6         | 17·6         | 19·2         | 21·0          | 23·5          | 28·0   |
| 1869.....           | 3·4  | 7·5          | 9·4          | 11·4         | 13·5         | 14·4         | 15·9         | 17·5         | 21·4         | 22·9          | 26·0          | 29·2   |
| 1870.....           | 3·0  | 5·4          | 6·5          | 7·6          | 9·2          | 10·2         | 12·0         | 13·6         | 16·1         | 23·3          | 25·1          | 27·6   |
| 1871.....           | 3·1  | 5·9          | 7·3          | 10·2         | 11·0         | 12·8         | 16·8         | 20·2         | 23·8         | 26·1          | 27·7          | 29·6   |
| Average of 10 years | 3·0  | 5·2          | 7·2          | 9·2          | 11·5         | 13·1         | 15·5         | 18·1         | 20·5         | 24·2          | 26·6          | 29·1   |
| 1872.....           | 4·1  | 7·6          | 10·0         | 14·1         | 16·8         | 20·4         | 23·7         | 27·9         | 32·3         | 36·8          | 41·0          | 46·6   |
| 1873.....           | 4·0  | 5·1          | 7·4          | 7·9          | 9·8          | 11·3         | 15·4         | 19·8         | 22·5         | 25·2          | 27·0          | 27·6   |
| 1874.....           | 1·7  | 3·5          | 4·8          | 6·5          | 7·2          | 8·3          | 11·2         | 15·6         | 18·5         | 22·1          | 25·3          | 28·3   |
| 1875.....           | 3·9  | 5·7          | 6·7          | 7·1          | 8·6          | 11·9         | 15·8         | 18·2         | 22·9         | 26·4          | 29·7          | 31·4   |
| 1876.....           | 1·1  | 4·5          | 7·4          | 9·5          | 10·0         | 12·0         | 14·0         | 16·9         | 20·3         | 24·8          | 28·3          | 36·0   |
| 1877.....           | 5·9  | 8·3          | 11·9         | 15·0         | 18·5         | 20·9         | 25·7         | 29·1         | 31·2         | 33·9          | 37·2          | 40·0   |
| 1878.....           | 3·1  | 5·1          | 6·6          | 8·0          | 11·8         | 14·8         | 15·2         | 17·7         | 21·0         | 23·9          | 25·4          | 26·9   |
| 1879.....           | 2·3  | 3·8          | 5·8          | 7·5          | 11·3         | 15·3         | 21·4         | 25·2         | 29·6         | 30·7          | 32·0          | 33·3   |
| 1880.....           | 1·0  | 3·5          | 5·3          | 9·0          | 9·6          | 12·5         | 17·3         | 18·2         | 21·4         | 22·6          | 25·0          | 27·6   |
| 1881.....           | 0·7  | 3·5          | 6·4          | 8·1          | 10·7         | 14·9         | 17·8         | 22·5         | 24·7         | 28·2          | 32·0          | 35·0   |
| Average of 20 years | 2·9  | 5·1          | 7·2          | 9·2          | 11·4         | 13·6         | 16·6         | 19·6         | 22·5         | 25·8          | 28·4          | 31·1   |
| 1882.....           | 1·9  | 4·0          | 6·4          | 9·1          | 12·0         | 15·1         | 20·1         | 23·7         | 28·0         | 30·4          | 35·0          | 37·6   |
| 1883.....           | 3·5  | 6·6          | 8·1          | 9·5          | 11·5         | 13·6         | 18·3         | 22·1         | 25·8         | 28·4          | 31·7          | 33·6   |
| 1884.....           | 3·8  | 7·2          | 9·9          | 11·8         | 13·9         | 14·7         | 17·6         | 19·4         | 22·4         | 24·8          | 27·3          | 30·4   |
| 1885.....           | 2·2  | 5·9          | 7·5          | 9·5          | 11·3         | 12·0         | 13·9         | 15·3         | 19·9         | 23·0          | 24·6          | 26·6   |
| 1886.....           | 3·8  | 5·9          | 8·5          | 9·9          | 15·0         | 16·4         | 19·9         | 22·3         | 24·7         | 28·8          | 31·7          | 36·1   |
| 1887.....           | 2·5  | 3·5          | 5·0          | 7·0          | 8·5          | 9·2          | 11·9         | 14·0         | 17·0         | 18·9          | 21·4          | 23·1   |
| 1888.....           | 1·8  | 2·3          | 5·7          | 7·4          | 10·1         | 14·5         | 19·1         | 21·8         | 22·8         | 23·9          | 27·8          | 30·2   |
| 1889.....           | 1·8  | 3·9          | 6·2          | 9·5          | 12·9         | 13·2         | 16·9         | 24·5         | 26·2         | 29·4          | 31·0          | 33·9   |
| 1890.....           | 3·3  | 4·6          | 7·3          | 8·4          | 9·9          | 12·8         | 14·9         | 17·5         | 20·7         | 22·2          | 28·2          | 29·9   |
| 1891.....           | 1·1  | 1·3          | 2·5          | 5·0          | 8·1          | 11·1         | 14·0         | 19·3         | 21·2         | 24·8          | 27·2          | 31·1   |
| Average of 30 years | 2·8  | 4·8          | 7·2          | 9·1          | 11·4         | 13·5         | 16·6         | 19·7         | 22·6         | 25·7          | 28·5          | 31·2   |
| 1892.....           | 2·1  | 3·9          | 4·5          | 5·3          | 8·7          | 11·8         | 14·4         | 19·9         | 22·8         | 25·8          | 29·3          | 31·1   |
| 1893.....           | 2·7  | 5·2          | 5·9          | 7·0          | 7·9          | 9·5          | 12·2         | 16·5         | 18·2         | 20·0          | 21·4          | 24·0   |
| 1894.....           | 2·9  | 4·8          | 5·9          | 8·3          | 9·9          | 13·4         | 16·7         | 19·0         | 19·3         | 24·3          | 26·0          | 28·8   |
| 1895.....           | 1·9  | 2·6          | 5·7          | 7·7          | 7·9          | 10·4         | 15·1         | 20·1         | 20·6         | 24·1          | 27·5          | 30·3   |
| 1896.....           | 1·7  | 3·0          | 6·0          | 7·3          | 7·6          | 10·1         | 17·5         | 19·5         | 24·0         | 26·1          | 26·8          | 30·6   |
| 1897.....           | 1·8  | 3·6          | 7·8          | 10·2         | 11·9         | 16·4         | 18·1         | 22·1         | 24·2         | 26·4          | 29·6          | 32·8   |
| 1898.....           | 1·2  | 3·8          | 4·7          | 8·2          | 11·9         | 14·9         | 15·5         | 19·1         | 23·9         | 27·1          | 29·1          | 31·0   |
| 1899.....           | 2·8  | 5·3          | 6·7          | 9·6          | 13·2         | 15·6         | 19·1         | 20·3         | 23·7         | 25·5          | 28·3          | 32·3   |
| 1900.....           | 2·0  | 4·3          | 5·2          | 6·9          | 9·6          | 12·8         | 15·8         | 20·6         | 22·4         | 26·0          | 30·9          | 34·1   |
| 1901.....           | 2·8  | 4·2          | 6·3          | 8·4          | 9·9          | 12·6         | 13·7         | 18·0         | 21·5         | 24·1          | 28·1          | 31·3   |
| Average of 40 years | 2·6  | 4·7          | 6·9          | 8·8          | 11·0         | 13·3         | 16·4         | 19·7         | 22·5         | 25·5          | 28·3          | 31·1   |
| 1902.....           | 1·9  | 4·4          | 6·0          | 8·6          | 12·1         | 14·3         | 17·9         | 20·3         | 24·0         | 25·3          | 28·6          | 31·0   |
| 1903.....           | 4·3  | 6·1          | 10·0         | 10·9         | 13·2         | 14·4         | 20·4         | 25·5         | 29·4         | 34·0          | 36·1          | 38·4   |

*Summary of Rainfall at Bann Reservoir, Lough Island Reavy,  
near Castlewellan.*

| YEAR                   | Jan. | First<br>2 mos. | First<br>3 mos. | First<br>4 mos. | First<br>5 mos. | First<br>6 mos. | First<br>7 mos. | First<br>8 mos. | First<br>9 mos. | First<br>10 mos. | First<br>11 mos. | 12 mos. |
|------------------------|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|---------|
|                        | in.  | in.             | in.             | in.             | in.             | in.             | in.             | in.             | in.             | in.              | in.              | in.     |
| 1862.....              | 6.0  | 8.6             | 14.2            | 17.5            | 20.5            | 25.5            | 29.9            | 31.9            | 33.9            | 39.6             | 44.6             | 52.9    |
| 1863.....              | 4.3  | 5.3             | 10.2            | 11.2            | 13.6            | 17.0            | 17.8            | 23.0            | 25.0            | 36.8             | 40.3             | 42.8    |
| 1864.....              | 5.2  | 6.4             | 13.1            | 15.1            | 16.8            | 19.5            | 21.1            | 22.9            | 26.0            | 30.5             | 40.8             | 44.7    |
| 1865.....              | 5.0  | 8.7             | 10.6            | 11.1            | 15.7            | 16.5            | 19.4            | 23.9            | 24.2            | 36.2             | 45.5             | 52.3    |
| 1866.....              | 7.7  | 11.7            | 20.1            | 24.0            | 24.9            | 29.9            | 31.3            | 35.3            | 41.7            | 46.5             | 50.4             | 54.6    |
| 1867.....              | 4.4  | 6.4             | 13.5            | 18.5            | 26.7            | 27.2            | 33.7            | 35.4            | 38.4            | 45.0             | 45.5             | 47.2    |
| 1868.....              | 3.8  | 5.5             | 8.6             | 9.9             | 12.3            | 12.5            | 12.9            | 19.9            | 22.4            | 24.3             | 32.2             | 43.3    |
| 1869.....              | 7.1  | 9.7             | 11.6            | 12.8            | 14.9            | 15.0            | 16.2            | 17.8            | 22.5            | 23.3             | 25.2             | 28.9    |
| 1870.....              | 5.9  | 14.3            | 15.2            | 16.0            | 19.4            | 19.9            | 20.8            | 22.4            | 25.2            | 39.9             | 42.4             | 48.1    |
| 1871.....              | 4.5  | 11.0            | 13.1            | 18.4            | 18.9            | 20.7            | 24.0            | 26.4            | 32.1            | 37.1             | 40.4             | 43.0    |
| Average of<br>10 years | 5.4  | 8.8             | 13.0            | 15.4            | 18.4            | 20.4            | 22.7            | 25.9            | 29.1            | 35.9             | 40.7             | 45.8    |
| 1872.....              | 7.2  | 16.2            | 19.2            | 22.8            | 24.3            | 27.6            | 30.7            | 34.0            | 38.0            | 43.4             | 50.2             | 61.2    |
| 1873.....              | 6.2  | 7.0             | 11.4            | 11.7            | 12.9            | 14.8            | 19.0            | 22.9            | 24.8            | 26.4             | 30.4             | 31.2    |
| 1874.....              | 2.1  | 6.1             | 6.9             | 9.9             | 10.2            | 10.9            | 12.9            | 16.8            | 21.6            | 27.9             | 31.5             | 35.5    |
| 1875.....              | 7.1  | 8.3             | 9.7             | 10.0            | 12.2            | 16.0            | 19.2            | 22.0            | 27.6            | 33.9             | 39.0             | 41.4    |
| 1876.....              | 2.3  | 6.0             | 8.1             | 10.1            | 10.3            | 12.3            | 13.1            | 16.5            | 22.3            | 31.2             | 39.9             | 52.9    |
| 1877.....              | 11.9 | 13.6            | 17.2            | 22.8            | 26.6            | 29.9            | 32.6            | 36.8            | 38.7            | 42.5             | 48.5             | 54.1    |
| 1878.....              | 2.2  | 6.4             | 6.8             | 8.6             | 15.5            | 18.4            | 18.8            | 21.4            | 26.2            | 30.3             | 31.2             | 31.9    |
| 1879.....              | 2.7  | 5.7             | 7.9             | 11.4            | 13.0            | 19.1            | 25.0            | 29.7            | 36.9            | 37.8             | 38.7             | 39.8    |
| 1880.....              | 1.1  | 5.5             | 7.2             | 13.0            | 13.1            | 16.1            | 22.3            | 22.6            | 27.1            | 29.4             | 32.9             | 33.8    |
| 1881.....              | 0.4  | 5.0             | 9.7             | 10.4            | 11.2            | 15.2            | 16.0            | 19.6            | 20.8            | 23.6             | 29.6             | 34.4    |
| Average of<br>20 years | 4.8  | 8.4             | 11.7            | 14.3            | 16.6            | 19.2            | 21.8            | 25.1            | 28.8            | 34.3             | 39.0             | 43.7    |
| 1882.....              | 1.6  | 7.5             | 10.0            | 16.1            | 18.5            | 21.2            | 25.9            | 30.4            | 34.8            | 41.7             | 48.3             | 53.1    |
| 1883.....              | 5.8  | 15.0            | 16.9            | 18.7            | 20.0            | 20.7            | 23.2            | 26.7            | 35.7            | 39.7             | 42.4             | 43.3    |
| 1884.....              | 5.7  | 13.6            | 21.0            | 23.1            | 25.6            | 25.9            | 28.9            | 30.2            | 32.1            | 33.8             | 38.1             | 40.6    |
| 1885.....              | 3.8  | 9.8             | 12.2            | 18.8            | 20.8            | 21.2            | 22.0            | 24.1            | 31.5            | 35.5             | 40.5             | 40.9    |
| 1886.....              | 2.2  | 4.4             | 7.8             | 9.6             | 13.3            | 16.6            | 19.9            | 21.9            | 24.1            | 33.2             | 37.0             | 42.3    |
| 1887.....              | 3.9  | 4.9             | 5.6             | 6.9             | 7.9             | 8.7             | 11.8            | 14.8            | 17.9            | 20.4             | 24.4             | 26.5    |
| 1888.....              | 1.6  | 1.6             | 7.2             | 10.0            | 14.1            | 19.3            | 25.9            | 27.4            | 27.9            | 29.1             | 37.5             | 43.3    |
| 1889.....              | 6.3  | 6.7             | 9.9             | 16.0            | 22.3            | 22.3            | 25.8            | 30.4            | 32.9            | 40.5             | 41.4             | 44.7    |
| 1890.....              | 4.8  | 7.5             | 13.2            | 15.2            | 17.7            | 20.5            | 22.5            | 26.7            | 31.1            | 32.4             | 43.3             | 46.3    |
| 1891.....              | 1.6  | 1.9             | 3.7             | 10.0            | 13.5            | 20.0            | 22.9            | 31.3            | 33.8            | 44.2             | 52.9             | 59.0    |
| Average of<br>30 years | 4.5  | 8.0             | 11.4            | 14.3            | 16.9            | 19.3            | 22.2            | 25.5            | 29.2            | 34.5             | 39.5             | 43.8    |
| 1892.....              | 4.1  | 6.0             | 6.5             | 7.4             | 11.6            | 15.2            | 17.0            | 23.2            | 27.1            | 34.0             | 40.0             | 41.3    |
| 1893.....              | 5.7  | 9.3             | 9.9             | 11.1            | 12.1            | 13.9            | 16.8            | 21.4            | 22.9            | 24.4             | 27.0             | 33.1    |
| 1894.....              | 5.9  | 8.8             | 9.4             | 13.9            | 17.9            | 21.7            | 25.6            | 27.8            | 28.1            | 39.0             | 44.7             | 48.6    |
| 1895.....              | 3.6  | 4.1             | 9.0             | 12.7            | 12.8            | 14.0            | 19.2            | 26.1            | 26.4            | 29.9             | 38.0             | 42.1    |
| 1896.....              | 1.8  | 4.6             | 8.3             | 9.3             | 9.7             | 13.1            | 19.8            | 21.7            | 28.5            | 30.9             | 33.1             | 40.3    |
| 1897.....              | 3.1  | 5.8             | 12.7            | 16.1            | 17.7            | 23.8            | 25.5            | 32.4            | 34.8            | 38.9             | 42.7             | 48.6    |
| 1898.....              | 1.9  | 4.7             | 5.7             | 12.4            | 17.0            | 21.3            | 21.8            | 25.5            | 29.5            | 34.6             | 39.1             | 43.0    |
| 1899.....              | 5.5  | 11.2            | 13.2            | 17.8            | 22.4            | 25.6            | 29.2            | 31.0            | 34.6            | 36.0             | 41.5             | 49.9    |
| 1900.....              | 3.3  | 8.7             | 9.7             | 12.3            | 17.2            | 20.6            | 25.0            | 30.1            | 31.3            | 37.0             | 44.2             | 49.1    |
| 1901.....              | 6.9  | 10.3            | 13.6            | 17.9            | 20.1            | 23.8            | 25.5            | 28.8            | 35.8            | 40.4             | 45.0             | 49.6    |
| Average of<br>40 years | 4.4  | 7.8             | 11.0            | 14.0            | 16.7            | 19.3            | 22.3            | 25.8            | 29.4            | 34.5             | 39.5             | 44.0    |
| 1902.....              | 3.3  | 8.9             | 11.1            | 16.2            | 23.2            | 27.3            | 32.5            | 37.0            | 41.8            | 44.5             | 54.3             | 59.2    |
| 1903.....              | 7.4  | 12.4            | 20.0            | 21.8            | 24.6            | 25.8            | 31.5            | 37.4            | 42.7            | 51.2             | 53.4             | 60.1    |

RAINFALL AND TEMPERATURE, JANUARY, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.      |                                   |                          |        | Days on which<br>-01 or more fell. | TEMPERATURE. |        |      |        | No. of<br>Nights<br>below<br>32°. |       |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------|--------------------------|--------|------------------------------------|--------------|--------|------|--------|-----------------------------------|-------|
|        |                                                                                                                                      | Total<br>Fall. | Diff. from<br>average,<br>1890-9. | Greatest in<br>24 hours. |        |                                    | Max.         |        | Min. |        | Shade                             | Grass |
|        |                                                                                                                                      |                |                                   | Depth                    | Date.  |                                    | Deg.         | Date.  | Deg. | Date.  |                                   |       |
| I.     | London (Camden Square) ...                                                                                                           | 2·33           | + ·62                             | ·35                      | 30     | 22                                 | 55·3         | 13     | 25·1 | 1      | 13                                | 22    |
| II.    | Tenterden.....                                                                                                                       | 3·71           | + 1·72                            | ·48                      | 27, 30 | 23                                 | 51·4         | 13     | 23·0 | 1      | 10                                | 22    |
| „      | Hartley Wintney .....                                                                                                                | 3·21           | + 1·26                            | ·63                      | 30     | 22                                 | 54·0         | 13     | 20·0 | 1      | 13                                | 22    |
| III.   | Hitchin .....                                                                                                                        | 2·19           | + ·48                             | ·46                      | 30     | 20                                 | 54·0         | 13     | 23·0 | 22     | 16                                | ...   |
| „      | Winslow (Addington) .....                                                                                                            | 2·73           | + 1·02                            | ·51                      | 30     | 21                                 | 52·0         | 13     | 20·0 | 23     | 20                                | 24    |
| IV.    | Bury St. Edmunds (Westley) .....                                                                                                     | 1·72           | + 0·3                             | ·28                      | 30     | 17                                 | 54·0         | 13     | 25·0 | 17     | ...                               | ...   |
| „      | Brundall .....                                                                                                                       | 1·51           | — ·16                             | ·26                      | 31     | 20                                 | 55·0         | 13     | 23·2 | 23     | 11                                | 21    |
| V.     | Alderbury .....                                                                                                                      | 4·89           | + 2·38                            | ·72                      | 27     | 23                                 | 47·0         | 28, 29 | 24·0 | 19     | 15                                | ...   |
| „      | Winterborne Steepleton .....                                                                                                         | 6·43           | ...                               | ·72                      | 30     | 23                                 | 50·9         | 13     | 23·0 | 23     | 11                                | 18    |
| „      | Torquay (Cary Green) .....                                                                                                           | 5·56           | ...                               | ·92                      | 29     | 21                                 | 54·1         | 19     | 31·5 | 1      | 1                                 | 13    |
| „      | Polapit Tamar [Launceston] .....                                                                                                     | 6·19           | + 2·86                            | ·72                      | 13     | 25                                 | 53·6         | 13     | 22·1 | 23     | 7                                 | 12    |
| VI.    | Stroud (Upfield) .....                                                                                                               | 3·77           | + 1·56                            | ·43                      | 31     | 23                                 | 52·0         | 18     | 27·0 | 22     | 14                                | ...   |
| „      | Church Stretton (Woolstaston) .....                                                                                                  | 3·13           | + ·67                             | ·45                      | 13     | 25                                 | 50·5         | 12, 18 | 24·0 | 1, 2   | 15                                | ...   |
| „      | Bromsgrove (Stoke Newington) .....                                                                                                   | 2·27           | + ·58                             | ·33                      | 27     | 17                                 | 49·0         | 27     | 21·0 | 22     | 20                                | ...   |
| VII.   | Boston .....                                                                                                                         | 1·57           | + ·19                             | ·35                      | 31     | 13                                 | 50·0         | 13     | 27·0 | 6      | ...                               | ...   |
| „      | Bawtry (Hesley Hall) .....                                                                                                           | 1·68           | + ·27                             | ·38                      | 31     | 19                                 | 54·0         | 13     | 24·0 | 22     | 16                                | ...   |
| „      | Derby (Midland Railway) .....                                                                                                        | 2·05           | + ·45                             | ·30                      | 31     | 20                                 | 52·0         | 13, 27 | 25·0 | 23     | 13                                | ...   |
| VIII.  | Bolton (The Park) .....                                                                                                              | 3·67           | + ·62                             | ·79                      | 12     | 25                                 | 50·5         | 27     | 26·8 | 1, 2   | 9                                 | 21    |
| IX.    | Wetherby (Ribston Hall) .....                                                                                                        | 2·46           | + ·80                             | ·41                      | 8      | 19                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| „      | Arncliffe Vicarage .....                                                                                                             | 7·62           | + 1·24                            | 1·06                     | 7      | 22                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| „      | Hull (Pearson Park) .....                                                                                                            | 1·43           | — ·24                             | ·30                      | 12     | 15                                 | 53·0         | 13     | 27·0 | 22     | 10                                | 26    |
| X.     | Newcastle (Town Moor) .....                                                                                                          | 1·76           | — ·05                             | ·48                      | 12     | 17                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| „      | Borrowdale (Seathwaite) .....                                                                                                        | 15·90          | + 1·05                            | 2·84                     | 9      | 18                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 5·37           | + 1·81                            | ·95                      | 7      | 23                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| „      | Haverfordwest (High St) .....                                                                                                        | 5·71           | + 1·09                            | ·95                      | 6      | 22                                 | 50·9         | 13     | 26·5 | 1      | 4                                 | 14    |
| „      | Aberystwith (Gogerddan) .....                                                                                                        | 4·79           | + ·54                             | ·81                      | 12     | 21                                 | 53·0         | 26     | 22·0 | 5, 23  | 12                                | ...   |
| „      | Llandudno .....                                                                                                                      | 3·48           | + ·95                             | ·49                      | 8      | 22                                 | 54·0         | 27     | 25·5 | 1      | 3                                 | ...   |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 4·02           | — ·56                             | ·69                      | 9      | 19                                 | 51·0         | 19     | 27·0 | 2      | 12                                | ...   |
| XIII.  | Edinburgh (Royal Observatory) .....                                                                                                  | 2·87           | ...                               | ·45                      | 7, 31  | 15                                 | 50·3         | 27     | 28·5 | 2      | 7                                 | 15    |
| XIV.   | Colmonell .....                                                                                                                      | 4·90           | + ·06                             | ·60                      | 30     | 18                                 | 50·0         | 19, 27 | 31·0 | 31     | ...                               | ...   |
| XV.    | Tighnabruach .....                                                                                                                   | 7·34           | ...                               | 1·08                     | 10     | 22                                 | 52·0         | 8      | 26·0 | 15     | 11                                | 13    |
| „      | Mull (Quinish) .....                                                                                                                 | 7·13           | + ·90                             | ·81                      | 6      | 24                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 2·71           | — ·59                             | ·75                      | 11     | 16                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| „      | Dundee (Eastern Necropolis) .....                                                                                                    | 1·85           | — ·68                             | ·40                      | 31     | 17                                 | 51·4         | 18     | 29·4 | 16     | 8                                 | ...   |
| XVII.  | Braemar .....                                                                                                                        | 3·65           | + ·87                             | ·56                      | 29     | 22                                 | 49·2         | 18     | 25·0 | 31     | 16                                | 29    |
| „      | Aberdeen (Cranford) .....                                                                                                            | 2·32           | — ·40                             | ·39                      | 31     | 24                                 | 51·0         | 18     | 26·0 | 11, 23 | 14                                | ...   |
| „      | Cawdor (Budgate) .....                                                                                                               | 1·61           | — ·61                             | ·48                      | 13     | 15                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| XVIII. | Strathconan (Dalbreac) .....                                                                                                         | 6·56           | + 2·02                            | 1·08                     | 29     | ...                                | ...          | ...    | ...  | ...    | ...                               | ...   |
| „      | Glencarron Lodge .....                                                                                                               | 10·67          | + ·28                             | 1·23                     | 6      | 25                                 | 51·0         | 27     | 25·7 | 5      | 11                                | ...   |
| XIX.   | Dunrobin Castle .....                                                                                                                | 1·18           | — 1·44                            | ·20                      | 28     | 13                                 | 52·0         | 18, 22 | 26·5 | 25     | 15                                | ...   |
| „      | Castletown .....                                                                                                                     | 1·86           | ...                               | ·47                      | 14     | 22                                 | 48·0         | 18a    | 26·0 | 25     | 15                                | ...   |
| XX.    | Killarney .....                                                                                                                      | 8·53           | + 2·88                            | 1·22                     | 3      | 24                                 | 53·0         | 13     | 33·0 | 26     | 0                                 | ...   |
| „      | Waterford (Brook Lodge) .....                                                                                                        | 4·97           | + 1·45                            | ·93                      | 2      | 21                                 | 51·5         | 7      | 28·0 | 22     | 7                                 | ...   |
| „      | Broadford (Hurdlestown) .....                                                                                                        | 3·90           | + ·77                             | ·46                      | 9      | 26                                 | 46·0         | 7      | 26·0 | 31     | 5                                 | ...   |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 4·01           | + ·94                             | ·67                      | 4      | 23                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| „      | Dublin (Fitz William Square) .....                                                                                                   | 2·54           | + ·40                             | ·55                      | 3      | 19                                 | 54·8         | 27     | 31·5 | 16     | 3                                 | 11    |
| XXII.  | Ballinasloe .....                                                                                                                    | 4·03           | + ·59                             | ·49                      | 13     | 27                                 | 58·5         | 26     | 27·0 | 1, 31  | 14                                | ...   |
| „      | Clifden (Kylemore House) .....                                                                                                       | 9·95           | + 1·98                            | 1·58                     | 6      | 23                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| XXIII. | Seaforde .....                                                                                                                       | 3·05           | — ·36                             | ·58                      | 3      | 18                                 | 50·0         | 18, 19 | ...  | ...    | ...                               | 11    |
| „      | Londonderry (Creggan Res.) .....                                                                                                     | 5·22           | + 1·56                            | ·69                      | 9      | 25                                 | ...          | ...    | ...  | ...    | ...                               | ...   |
| „      | Omagh (Edenfel) .....                                                                                                                | 4·64           | + 1·13                            | ·60                      | 12     | 23                                 | 50·0         | 26     | 28·0 | 30     | 12                                | 21    |

+ Shows that the fall was above the average; — that it was below it. a and 22nd, 23rd.

## SUPPLEMENTARY RAINFALL, JANUARY, 1904.

| Div.  | STATION.                       | Rain.<br>inches | Div.   | STATION.                     | Rain.<br>inches |
|-------|--------------------------------|-----------------|--------|------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....    | 5·20            | XI.    | New Radnor, Ednol .....      | 5·07            |
| „     | Sheppey, Leysdown .....        | 2·65            | „      | Rhayader, Nantgwilt .....    | 8·57            |
| „     | Hailsham .....                 | 5·45            | „      | Lake Vyrnwy .....            | 6·04            |
| „     | Crowborough .....              | 5·96            | „      | Ruthin, Plâs Drâw.....       | 3·18            |
| „     | Ryde, Beldornie Tower.....     | ...             | „      | Criccieth, Talarvor.....     | 3·53            |
| „     | Einsworth, Redlands.....       | 4·10            | „      | Anglesey, Lligwy .....       | 4·65            |
| „     | Alton, Ashdell .....           | 6·10            | „      | Douglas, Woodville .....     | 3·10            |
| „     | Newbury, Welford Park ...      | 4·55            | XII.   | Stoneykirk, Ardwell House    | 2·97            |
| III.  | Harrow Weald .....             | 2·85            | „      | Dalry, Old Garroch .....     | 6·43            |
| „     | Oxford, Magdalen College..     | 2·84            | „      | Langholm, Drove Road.....    | 5·13            |
| „     | Banbury, Bloxham.....          | 3·17            | „      | Moniaive, Maxwellton House   | 4·66            |
| „     | Pitsford, Sedgebrook.....      | 2·41            | „      | Lilliesleaf, Riddell .....   | 2·96            |
| „     | Huntingdon, Brampton.....      | 1·81            | XIII.  | N. Esk Reservoir [Penicuick] | 3·25            |
| „     | Wisbech, Bank House .....      | 1·47            | XIV.   | Maybole, Knockdon Farm..     | 3·29            |
| IV.   | Southend .....                 | 2·22            | „      | Glasgow, Queen's Park .....  | ...             |
| „     | Colchester, Lexden.....        | 2·14            | XV.    | Inveraray, Newtown .....     | 6·69            |
| „     | Saffron Waldon, Newport...     | 2·13            | „      | Ballachulish, Ardsheal ..... | 11·47           |
| „     | Rendlesham Hall .....          | 1·86            | „      | Campbeltown, Redknowe...     | 4·85            |
| „     | Swaffham .....                 | 1·80            | „      | Islay, Eallabus .....        | 5·82            |
| „     | Blakeney .....                 | 1·27            | XVI.   | Dollar .....                 | 2·93            |
| V.    | Bishop's Cannings .....        | 3·54            | „      | Balquhider, Stronvar .....   | 8·40            |
| „     | Ashburton, Druid House ...     | 9·17            | „      | Coupar Angus Station .....   | 2·07            |
| „     | Okehampton, Oaklands.....      | 7·27            | „      | Blair Atholl.....            | 3·39            |
| „     | Hartland Abbey .....           | 5·16            | „      | Montrose, Sunnyside.....     | 2·19            |
| „     | Lynmouth, Rock House ...       | 6·02            | XVII.  | Alford, Lynturk Manse ...    | 1·28            |
| „     | Probus, Lamellyn .....         | 5·93            | „      | Keith, H. R. S. ....         | 1·27            |
| „     | Wellington, The Avenue ...     | 4·00            | XVIII. | Fearn, Lower Pitkerrie.....  | ...             |
| „     | North Cadbury Rectory ..       | 3·40            | „      | S. Uist, Askernish .....     | 4·60            |
| VI.   | Clifton, Pembroke Road ...     | 3·58            | „      | Invergarry .....             | 8·55            |
| „     | Moreton-in-Marsh, Longboro'    | 3·55            | „      | Aviemore, Alvie Manse.....   | 2·10            |
| „     | Ross, The Graig .....          | 3·10            | „      | Loch Ness, Drumnadrochit.    | 3·61            |
| „     | Shifnal, Hatton Grange.....    | 2·80            | XIX.   | Invershin .....              | 1·64            |
| „     | Wem Rectory .....              | 2·52            | „      | Altnaharra .....             | 3·21            |
| „     | Cheadle, The Heath House.      | 2·56            | „      | Bettyhill .....              | 2·60            |
| „     | Coventry, Kingswood .....      | 2·71            | „      | Watten, H. R. S. ....        | 1·34            |
| VII.  | Market Overton .....           | 2·75            | XX.    | Cork, Wellesley Terrace ...  | 5·30            |
| „     | Market Rasen .....             | 1·67            | „      | Darrynane Abbey .....        | 7·08            |
| „     | Worksop, Hodsock Priory..      | 1·96            | „      | Glenam [Clonmell] .....      | 5·54            |
| VIII. | Neston, Hinderton.....         | 2·15            | „      | Ballingarry, Hazelfort ..... | 3·61            |
| „     | Southport, Hesketh Park...     | 2·86            | „      | Miltown Malbay.....          | 5·69            |
| „     | Chatburn, Middlewood .....     | 3·75            | XXI.   | Gorey, Courtown House ...    | 3·82            |
| „     | Duddon Valley, Seathwaite Vic. | 10·65           | „      | Moynalty, Westland .....     | 3·95            |
| IX.   | Langsett Moor, Up. Midhope     | 5·14            | „      | Athlone, Twyford .....       | 3·37            |
| „     | Baldersby .....                | 2·52            | „      | Mullingar, Belvedere.....    | 3·44            |
| „     | Scalby, Silverdale .....       | 2·54            | XXII.  | Woodlawn .....               | 4·23            |
| „     | Ingleby Greenhow Vicarage      | 2·69            | „      | Westport, Murrisk Abbey..    | 7·42            |
| „     | Middleton, Mickleton .....     | 2·56            | „      | Crossmolina, Enniscoe .....  | 6·53            |
| X.    | Beltingham .....               | 2·54            | „      | Collooney, Markree Obsy...   | 4·63            |
| „     | Bamburgh.....                  | 1·79            | XXIII. | Enniskillen, Portora .....   | 3·56            |
| „     | Keswick, The Bank .....        | 7·14            | „      | Warrenpoint .....            | 3·55            |
| „     | Melmerby Rectory .....         | 3·70            | „      | Banbridge, Milltown .....    | 2·80            |
| XI.   | Llanfrechfa Grange.....        | 6·19            | „      | Belfast, Springfield .....   | 3·45            |
| „     | Treherbert, Tyn-y-waun ...     | 13·49           | „      | Bushmills, Dundarave .....   | 4·12            |
| „     | Llandovery, Tonn .....         | 5·47            | „      | Stewartstown .....           | 3·53            |
| „     | Castle Malgwyn .....           | 6·48            | „      | Killybegs .....              | 5·32            |
| „     | Llandefaelog-fach .....        | 5·27            | „      | Horn Head .....              | 5·22            |

## METEOROLOGICAL NOTES ON JANUARY, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm  
R for Rain; H for Hail; S for Snow.

## ENGLAND.

LONDON, CAMDEN SQUARE.—Very little relief was experienced from the gloomy and ungenial conditions which prevailed in December, and dark, damp weather continued almost throughout, with temperature nearly always above the average. Measurable R fell on 26 days and the total duration was 79·5 hours, whilst the duration of sunshine reached only 20·5 hours. Mean temp. 39°·5, or 1°·4 above the average.

TENTERDEN.—The first half was warm and showery, and the end very wet, but it was colder from 15th to 26th, with alternate frost and thaw. TS and violent gale from 1.35 to 2.35 a.m. on 14th. Duration of sunshine 38 hours.

SHEPPEY, LEYSDOWN.—A mild, rainy month, with much wind from 7th to 14th. Sharp TS on the early morning of 13th. The temp. was below 32° all day only on 1st and 24th.

CROWBOROUGH.—A wet, gloomy month, with R considerably in excess of the average and the greatest in January since 1877. Frost occurred on 11 days. T and L on 31st and S and H. Mean temp. 37°·4.

HARTLEY WINTNEY.—A black January. The weather was varied, cloud and gloom prevailing. Slight frost in the first and third weeks. Distant TS on 13th and L on 13th, 14th and 15th. Ozone on 18 days with a mean of 4·4.

WINSLOW, ADDINGTON.—A very disheartening month for all employed on the land, the ground being in a complete state of saturation.

PITSFORD, SEDGEBROOK.—A cold, wet, dull and wretched month. R ·75 in. above the average of 10 years. Mean temp. 37°·6.

NORWICH, BRUNDALL.—Dull and damp, with mean temp, 1°·0 above the average. The seventh mild January in succession.

WINTERBORNE STEEPLTON.—R nearly double the average of 11 years, and mean temp. nearly 1°·0 above the average.

TORQUAY, CARY GREEN.—R 2·31 in. above the average. Mean temp. 44°·1, or 1°·3 above the average. Duration of sunshine 53·4 hours, or 8·5 hours below the average. Mean amount of ozone 4·6; max. 8·0 on 15th and 27th, min. 1·0.

ASHBURTON, DRUID HOUSE.—Heavy R at times, and cold with H and S in the middle of the month, preceded by T and L on 13th.

NORTH CADBURY RECTORY.—No S and little frost. The pond was higher than ever seen before; the ground saturated and all farm work stopped.

CLIFTON, PEMBROKE ROAD.—Wet and mild, except a week of dry weather with frost and high bar. from 18th to 25th. T, L and H at 8·45 p.m. on 13th.

ROSS, THE GRAIG.—The temp. was above the average both by day and night, and the number and severity of frosts were less than usual. The R was somewhat more than the average and the number of rainy days much more. Gloomy and cloudy, and the meadows almost always saturated with water.

WORKSOP, HODSOCK PRIORY.—Dull and mild, with no S or sharp frost.

BOLTON, THE PARK.—Dull, with 22 days absolutely without sunshine, whilst the mean relative humidity, 93, was the highest on record. Mean temp. 38°·6, or 0·6 above the average. Duration of sunshine 11·5 hours, or 9·5 hours below the average. Slight S occurred on 3 days.

SOUTHPORT, HESKETH PARK.—Humid and rather mild, with low bar. and a deficiency of sunshine, the total duration being 10 hours below the average and the mean temp. 1°·2 above the average. The total R was only ·17 in. above the average. Gales on 7 days. Fogs on 10 days. Ice on lake on 7 days.

SEATHWAITE VICARAGE.—Uniformly mild and almost continuously wet with but one slight fall of S on 15th.

HULL, PEARSON PARK.—Extremely dull and sunless, with frequent fog or mist, and periods of cold with H on 10th and sleet on 2nd. Gale on 14th.

BAMBURGH.—As a whole very mild with light and moderate winds. Slight frost, no S, and little fog. Not at all seasonable.

## WALES AND THE ISLANDS.

LLANFRECHFA GRANGE.—Mild, with very little frost and much fog and mist.

LLANDOVERY.—An unusually large number of wet days and frequency of stormy weather. Mean shade temp.  $39^{\circ}8$ . Prevailing wind S.W.

HAVERFORDWEST.—Cold, dry and cloudy, with S.E. wind to 3rd, after which a cold, wet period set in lasting more or less till the 20th. Finer and drier to 26th, and from that date to the end alternate frosty nights and rainy days. Stormy from 12th to 15th. Duration of bright sunshine 31.6 hours.

ABERYSTWITH, GOGERDDAN.—Very mild, with little frost, a great deal of R and no S. Great storm on the evening of 13th, with wind chiefly N.W. and S.W.

DOUGLAS, WOODVILLE.—R below, and temp. generally above, the average, and unusual number of fine and even sunny days, but much stormy weather and some three violent gales. Slight S fell on 2 days, H on 4, and there was much L on 12th and 13th. Many spring flowers were already in bloom.

## SCOTLAND.

MONIAIVE, MAXWELTON HOUSE.—Wet and cold but not severe, except from 16th to 25th, when it was dry. A little S on 25th and 31st, but no heavy fall.

LILLIESLEAF, RIDDELL.—Wind high and continually W. or S.W. The temp. kept round freezing point. No S.

INVERARAY, NEWTOWN.—Mild, unsettled and rainy.

BALLACHULISH, ARDSHEAL.—Mild and wet. R 4.46 in. above the average.

MULL, QUINISH.—Sharp frost for the first few days. Thereafter mild and very wet, with short and sudden gales from S. to S.W.

COUPAR ANGUS.—Wet days above, but R slightly below, the average. Mean temp.,  $37^{\circ}1$ , was  $1^{\circ}7$  above the average.

ABERDEEN, CRANFORD.—Wet with overcast sky and few bright days, but very little S. Light wind from S., S.W. and W.

LYNTURK MANSE.—The last fortnight was specially fine for the season. Very little S for the month.

DRUMNADROCHIT.—R 15 in. below, but rainy days 1 above, the average. Distant T on 10th whilst S was falling.

GOLSPIE, DUNROBIN CASTLE.—Fairly open and suitable for outdoor operations, though changeable.

ALTNAHARRA.—Very fair and open, and though generally very cold, there were some exceptionally mild days.

CASTLETOWN.—Fresh open weather. S.E. to S.W. winds in the first part, with frosty nights. On 14th the bar. fell to 28.55 in., and on 15th and 16th there was a strong N.W. gale. In the latter part N.W., W. and S. winds.

## IRELAND.

CORK, WELLESLEY TERRACE.—R 1.30 in. over the average. Anti-cyclone on 27th, accompanied by high bar., calm and dry atmosphere and fog. Great storm from S.W. on 29th. Sleet and some S on 31st. T and L on 4th and 27th.

MILTOWN MALBAY.—Generally cold and stormy, with much T, L, and H, except one mild week from 16th to 23rd, with sea-fog and mist. Although it was boisterous and squally, there was no great storm.

DUBLIN, FITZWILLIAM SQUARE.—An open, dull, damp month, with frequent R. The mean temp. was  $42^{\circ}6$ , or  $1^{\circ}0$  above the average of 30 years.

COLLOONEY, MARKREE OBSERVATORY.—Although R fell on 27 days, the total was not above the average. Very mild throughout. Wind generally from S.E. to S.W. and W. with a few gales. H on 4 days, T on 1, L on 4, and fog on 2.

BELFAST, SPRINGFIELD.—An average January, and on the whole satisfactory, frost being rather prominent.

OMAGH, EDENFEL.—The first fortnight was very wet, raw and unsettled. A coldish and drier spell followed, with a return to wet and humid weather at the end. The temp. was above the average, and it could hardly be said that the ground was once covered with S, so short was its duration.

Climatological Table for the British Empire, August, 1903.

| STATIONS.<br><br><i>(Those in italics are South of the Equator.)</i> | Absolute. |       |          |                 | Average. |      |            |           | Absolute.    |                | Total Rain. |       | Aver.  |
|----------------------------------------------------------------------|-----------|-------|----------|-----------------|----------|------|------------|-----------|--------------|----------------|-------------|-------|--------|
|                                                                      | Maximum.  |       | Minimum. |                 | Max.     | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth.      | Days. | Cloud. |
|                                                                      | Temp.     | Date. | Temp.    | Date.           |          |      |            |           |              |                |             |       |        |
| London, Camden Square                                                | 80·6      | 8     | 45·4     | 11              | 70·1     | 52·4 | 52·2       | 75        | 125·3        | 41·4           | 4·24        | 18    | 5·4    |
| Malta                                                                | 96·3      | 14    | 63·5     | 17 <sup>a</sup> | 87·5     | 68·4 | 66·5       | 71        | 145·3        | 58·2           | ·00         | 0     | 0·6    |
| Lagos, W. Africa                                                     | 84·1      | 27    | 70·6     | 13              | 81·2     | 73·1 | 70·7       | 78        | 144·0        | 68·0           | ·69         | 13    | ...    |
| Cape Town                                                            | 77·2      | 21    | 39·6     | 20              | 62·2     | 46·2 | 46·2       | 74        | ...          | ...            | 3·22        | 14    | 4·4    |
| Durban, Natal                                                        | 84·2      | 7     | 49·2     | 19              | 76·6     | 56·7 | ...        | ...       | 133·6        | ...            | 1·85        | 7     | 3·3    |
| Mauritius                                                            | 78·7      | 1     | 56·3     | 22              | 75·9     | 62·3 | 58·7       | 71        | 141·1        | 49·0           | 1·77        | 19    | 6·5    |
| Calcutta                                                             | 90·0      | 5     | 74·8     | 8               | 87·9     | 78·4 | 77·8       | 86        | 156·2        | 73·6           | 10·17       | 17    | 8·7    |
| Bombay                                                               | 87·1      | 17    | 74·1     | 21              | 84·4     | 77·5 | 76·1       | 86        | 140·7        | 73·2           | 18·23       | 26    | 8·3    |
| Madras                                                               | 100·5     | 4     | 72·9     | 17              | 92·9     | 77·2 | 74·0       | 77        | 142·8        | 72·0           | 7·88        | 14    | 6·3    |
| Kodaikanal                                                           | 65·4      | 8, 10 | 50·4     | 10              | 62·3     | 52·4 | 51·8       | 86        | 144·6        | 42·1           | 12·94       | 19    | 7·9    |
| Colombo, Ceylon                                                      | 90·5      | 21    | 71·6     | 11              | 87·0     | 77·1 | 72·3       | 78        | 146·3        | 70·0           | 7·54        | 18    | 6·7    |
| Hongkong                                                             | 91·2      | 1     | 73·1     | 17              | 85·8     | 77·1 | 75·8       | 85        | 142·7        | ...            | 14·97       | 21    | 6·9    |
| Melbourne                                                            | 67·8      | 31    | 30·3     | 29              | 56·2     | 41·1 | 40·7       | 72        | 127·8        | 23·5           | ·48         | 8     | 5·4    |
| Adelaide                                                             | 70·0      | 9     | 37·7     | 6               | 53·8     | 45·4 | 43·5       | 71        | 126·7        | 29·6           | 2·34        | 14    | 5·3    |
| Coolgardie                                                           | 76·2      | 22    | 34·4     | 3               | 65·0     | 42·6 | 40·7       | 61        | 144·2        | 27·6           | ·65         | 4     | 3·6    |
| Sydney                                                               | 70·0      | 11    | 42·9     | 13              | 60·3     | 47·4 | 42·8       | 75        | 98·0         | 31·9           | 5·16        | 16    | 4·7    |
| Wellington                                                           | 62·7      | 12    | 31·0     | 2               | 51·6     | 40·7 | 39·6       | 79        | 108·0        | 21·0           | 9·88        | 23    | 6·7    |
| Auckland                                                             | 61·0      | 10    | 38·5     | 4               | 56·3     | 46·4 | 42·3       | 72        | 120·0        | 35·5           | 3·37        | 20    | 6·1    |
| Jamaica, Negril Point.                                               | 92·1      | 10    | 69·7     | 29              | 87·0     | 73·6 | 71·1       | 81        | ...          | ...            | 11·25       | 21    | ...    |
| Trinidad                                                             | ...       | ...   | ...      | ...             | ...      | ...  | ...        | ...       | ...          | ...            | ...         | ...   | ...    |
| Grenada                                                              | 88·2      | 4     | 72·0     | 28              | 84·1     | 74·7 | 71·9       | 78        | 147·0        | ...            | 14·59       | 27    | 4·3    |
| Toronto                                                              | 83·0      | 6     | 46·9     | 1               | 72·1     | 55·4 | 55·9       | 77        | 101·2        | 42·9           | 3·65        | 11    | 6·0    |
| St. John's, N.B.                                                     | 77·7      | 22    | 38·0     | 29              | 70·9     | 47·4 | 48·8       | 59        | ...          | ...            | 3·18        | 12    | 4·9    |
| Winnipeg                                                             | 83·0      | 31    | 37·0     | 8               | 72·5     | 49·8 | ...        | ...       | ...          | ...            | 2·00        | 15    | 5·6    |
| Victoria, B.C.                                                       | 73·7      | 17    | 43·2     | 31              | 66·4     | 52·7 | ...        | ...       | ...          | ...            | 1·06        | 8     | 5·6    |
| Dawson                                                               | ...       | ...   | ...      | ...             | ...      | ...  | ...        | ...       | ...          | ...            | ...         | ...   | ...    |

*a* and 18.

MALTA.—Mean temp. of air 1°·2 below, dew point 0°·4 and R·08 in. below averages. Mean hourly velocity of wind 6·7 miles, or 0·6 below average. Mean temp. of sea 79°·4.

LAGOS, W. AFRICA.—Mean hourly velocity of wind 9 miles.

MAURITIUS.—Mean temp. of air 0°·4 above, dew point 0°·8 above and R·58 in., below averages. Mean hourly velocity of wind 12·5 miles, or 0·2 below average; extremes, 30·8 on 18th and 1·7 on 21st; prevailing direction E.S.E.

MADRAS.—TSS on 8 days. Bright sunshine 136·1 hours.

KODAIKANAL.—Mean temp. of air 56°·0. Mean velocity of wind 323 miles per day. Bright sunshine 95·5 hours.

COLOMBO, CEYLON.—Mean temp. of air 81°·2 or 0°·5 above, of dew point 0°·9 below and R 3·88 in. above averages. Mean hourly velocity of wind 8·6 miles, prevailing direction S.W. TSS on 4 days.

HONGKONG.—Mean temp. of air 80°·9. Sunshine 158 hours. Mean hourly velocity of wind 8·7 miles.

Sydney.—Mean temp. of air 0°·9 below, humidity 1·4, and R 1·90 in. above, averages.

Wellington.—Mean temp. of air 2°·3 below, and R 4·68 in. above, averages.

Auckland.—Mean temp. of air 1°·0, and R nearly one inch below averages.

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## THE DAWSON-LANDER SUNSHINE RECORDER.

IN our very brief notice of this instrument when describing the Meteorological Exhibition at Southport we inadvertently did less than justice to a very ingenious piece of apparatus, and we are now glad to give a fuller account of it. The recorder is very compact, strongly and neatly made and the whole measures only 4 inches in diameter. The instrument consists of a fixed drum, on which a piece of silver chloride photographic printing paper is fixed under a film of transparent celluloid. A light-tight outer cover is rotated by a clock once in 24 hours and a very narrow slit is thereby always directed towards the sun. A funnel-shaped hood protects the slit from diffused light and allows of an error of about half-an-hour in the clock before the direct sunlight is cut off from the slit. The general external appearance is shown in Fig. 1. By an ingenious device the drum carrying the sensitive paper is made to travel (without rotation) along the axis of the cylinder, so that the records of a number of days may be obtained one below the other. We reproduce in Fig. 2 a whole month's record.

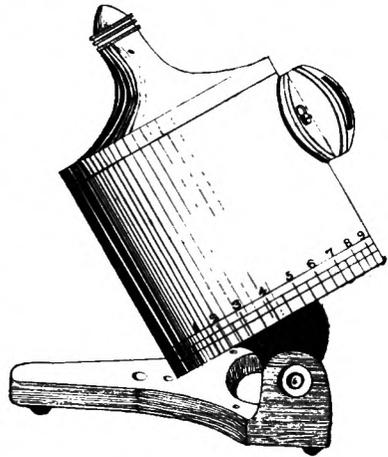


Fig. 1.—The Dawson-Lander Sunshine Recorder.

The advantages of the instrument are obvious. The use of chloride of silver paper makes it possible to have a standard of intensity of sunshine which can readily be reproduced, thereby distinguishing it from other photographic recorders, which depend on the fickle ferrous-prussiate paper. The same size of paper is used at all times of the year and the instrument is as serviceable for the twenty-four hours sunshine of the polar regions as for temperate latitudes. The disadvantage is that if the clock is not correctly set, no record can be

obtained, but we understand that there is no practical difficulty on that account. A more difficult question is likely to be the selection of the exact shade of intensity of the print which is to be measured as bright sunshine. Here the very perfection of the record, which faithfully sets down the intensity as well as the duration of sunlight, is almost a drawback. By narrowing the slit to one-hundredth of an inch the inventors state that the amount of sunshine recorded is the same as that obtained by the Campbell-Stokes instrument.

The Dawson-Lander sunshine recorder is made by Messrs. Lander and Smith, of Canterbury.

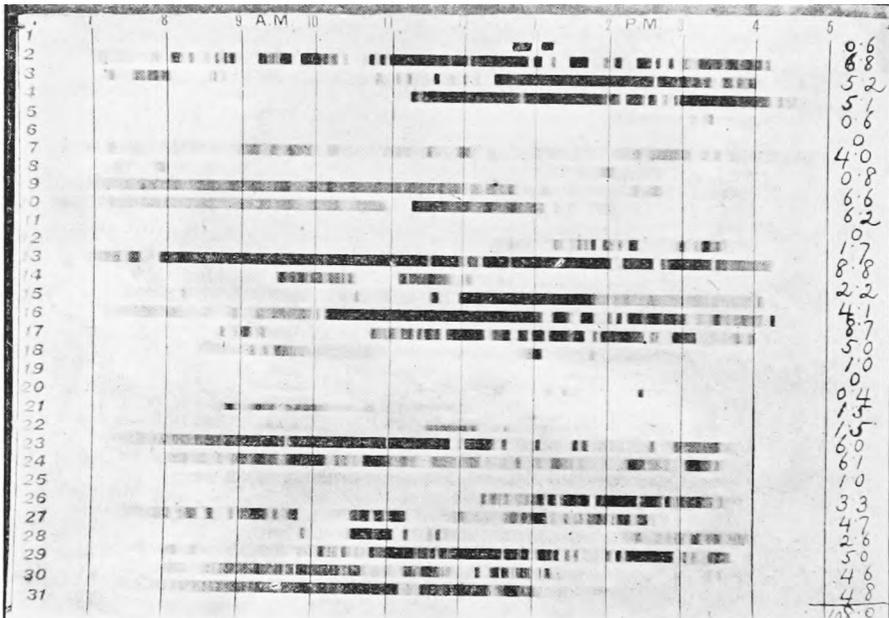


Fig. 2.—Specimen of the Record of the Dawson-Lander Sunshine Recorder.

### FIVE MONTHS' WINTER RAINFALL.

The Table compares the total rainfall of the five months of the winter half-year with the average; the first column of figures gives the number of inches at each station in excess (+) or in defect (—) of the average, and in the second column the total amount of rain is given as a ratio taking the average as 100. It will be remembered that November and December, 1903, were months of small rainfall, the amount being considerably below the average in almost all parts of the country. October, 1903, was however an exceptionally wet month; and the two months of 1904 which have passed have also been very wet in most parts of the country.

October, 1903—February, 1904.

| Stations.        | Diff. from Aver. | Per cent. of Aver. | Stations.        | Diff. from Aver. | Per cent. of Aver. | Stations.      | Diff. from Aver. | Per cent. of Aver. |
|------------------|------------------|--------------------|------------------|------------------|--------------------|----------------|------------------|--------------------|
|                  | in.              |                    |                  | in.              |                    |                | in.              |                    |
| London .....+    | 4·17             | 142                | Arnelcliffe ...+ | 5·51             | 118                | Braemar ...—   | ·64              | 96                 |
| Tenterden .....+ | 4·01             | 135                | Hull .....+      | ·96              | 109                | Aberdeen ...+  | 2·68             | 118                |
| Hartly Wntn'y +  | 7·48             | 167                | Newcastle...+    | 6·69             | 161                | Cawdor .....—  | ·41              | 97                 |
| Hitchin .....+   | 4·73             | 147                | Seathwaite +     | 2·88             | 104                | Glencarron —   | 2·85             | 94                 |
| Winslow .....+   | 4·75             | 146                | Cardiff .....+   | 11·13            | 159                | Dunrobin ...+  | ·72              | 105                |
| Westley .....+   | 2·74             | 126                | Haverdwest+      | 7·56             | 133                | Darrynane +    | 4·88             | 120                |
| Brundall .....+  | 1·69             | 116                | Gogerddan +      | 8·24             | 137                | Waterford +    | 8·17             | 146                |
| Alderbury .....+ | 9·10             | 168                | Llandudno +      | 3·79             | 126                | Broadford..+   | 7·28             | 149                |
| Ashburton .....+ | 14·20            | 151                | Dumfries ...+    | 2·74             | 112                | Carlow .....+  | 1·93             | 112                |
| Polapit Tamar +  | 15·09            | 184                | Lilliesleaf ...+ | 4·30             | 132                | Dublin .....+  | ·15              | 101                |
| Stroud .....+    | 6·68             | 156                | Colmonell ...+   | 5·45             | 125                | Mullingar ...+ | 2·92             | 119                |
| Woolstaston ...+ | 6·08             | 146                | Glasgow ...+     | 2·29             | 113                | Ballinasloe +  | 3·07             | 119                |
| Boston .....+    | 3·81             | 145                | Inveraray ...+   | 2·24             | 106                | Clifden ...+   | 4·05             | 111                |
| Hesley Hall ...+ | 2·63             | 128                | Islay .....+     | 5·44             | 123                | Crossmolina +  | 5·69             | 121                |
| Derby .....+     | 4·04             | 143                | Mull .....+      | 6·76             | 124                | Seaforde ...+  | 4·44             | 126                |
| Bolton .....+    | 6·75             | 139                | Loch Leven +     | 1·13             | 107                | Londonderry+   | 3·06             | 117                |
| Wetherby .....+  | 7·79             | 180                | Dundee .....+    | 1·71             | 113                | Omagh .....+   | 6·93             | 139                |

The winter has been a dry one only in the north of Scotland, where there is a considerable area stretching from Braemar through Inverness to Glencarron in which the rainfall of the five months was below the average. No other part of the country has been so favoured. Except for small patches in the south of Scotland and in the east of Ireland, the whole of the northern kingdom and the sister isle have had an excess of rainfall decidedly less than 25 per cent., and thus cannot seriously complain of a wet winter.

In England, on the other hand, only the Lake District and a narrow strip on the east coast have had so small an excess as 25 per cent., a stretch of country in the east of Northumberland, Durham and Yorkshire, had an excess greater than 50 per cent., and one station showed as much as 80 per cent. The south-east of Wales and the whole of south-western England, including the counties Cornwall, Devon, Somerset, Gloucester, Dorset, Wilts, Hants, Berks, Oxford and Worcester, had also an extremely wet winter, the excess exceeding 50 per cent. This means that the average amount of rain for the period had fallen and, at least, half as much more. At one station on the boundary line between Cornwall and Devon, the excess reached the remarkable amount of 84 per cent.

The Tables on pp. 36-37 show how the heavy rains of February were distributed. During that month the north-east of Scotland was remarkably dry; but a very large part of our islands had more than four inches of rain, the greater part of Cornwall, Devon and Wales, having more than six inches. London was comparatively dry, and the east of England had little to complain of so far as moisture is concerned, though cloudy skies and low temperatures made the month far from pleasant in its weather.

**METEOROLOGICAL OBSERVATIONS OBTAINED BY  
THE USE OF KITES, OFF THE WEST COAST  
OF SCOTLAND, 1902.**

A PAPER embodying the results of the kite experiments made by Mr. Dines off the west coast of Scotland during July and August, 1902, was read before the Royal Society on May 14th, 1903, by Dr. W. N. Shaw, F.R.S., and Mr. Dines. It is published in the *Philosophical Transactions*, Series A, Vol. 202, pp. 123—141. A description of the instruments used, and a tabular statement of the results of each ascent, as laid before the British Association in September, 1902, was given in this Magazine for October, 1902. In the present paper the results were presented graphically in the form of a diagram, representing the height in the air of a series of temperature at successive intervals of  $1^{\circ}$  C. for each ascent. For purposes of comparison the barometer curves at Fort William and Ben Nevis, and some particulars of the dry and wet bulb temperatures, are printed on the same diagram.

The average fall of temperature for each 500 metres of ascent was found to be as follows:—

|                  | July.                             | August.                           |
|------------------|-----------------------------------|-----------------------------------|
| 0 to 500 metres, | 22 ascents, $3^{\circ}\cdot 0$ C. | 13 ascents, $2^{\circ}\cdot 6$ C. |
| 500 „ 1000 „     | 16 „ $2^{\circ}\cdot 8$           | 11 „ $2^{\circ}\cdot 8$           |
| 1000 „ 1500 „    | 9 „ $2^{\circ}\cdot 2$            | 9 „ $2^{\circ}\cdot 3$            |
| 1500 „ 2000 „    | 2 „ $2^{\circ}\cdot 0$            | 7 „ $2^{\circ}\cdot 1$            |
| 2000 „ 2500 „    | 1 „ $2^{\circ}\cdot 0$            | 3 „ $2^{\circ}\cdot 0$            |
| 2500 „ 3000 „    | ... „ ...                         | 2 „ $2^{\circ}\cdot 0$            |
| 3000 „ 3500 „    | ... „ ...                         | 2 „ $1^{\circ}\cdot 7$            |

It was shown that on the approach of a barometric depression the temperature gradients diminish on the average by as much as 50 per cent., and the paths of the depressions which produced the changes are also shown on maps.

The average value of the temperature gradient per 100 metres at different heights varies from  $0^{\circ}\cdot 56$  C. in a column of 500 metres to  $0^{\circ}\cdot 43$  at 3500 metres, and the average differs very slightly from that given in Hann's "*Meteorologie*," or from the conventional figure in common use. It was pointed out that a moderately strong wind was required for the higher ascents, and that the values obtained at great altitudes therefore refer to a more or less special type of weather.

Comparisons between the temperature observed at Ben Nevis and that in the free air at the same altitude showed that the latter are on the average  $2^{\circ}\cdot 6$  higher, a result apparently due to the mechanical action of the sides of the mountain itself in causing an upward flow.

## ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday evening, February 17th, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

The following gentlemen were elected Fellows of the Society : Rev. W. C. Eppstein, M.A., Mr. T. Green, Mr. N. V. Iyya, Mr. W. Matern, and Mr. T. Edmondston Saxby, L.R.C.S.

Mr. E. Mawley read his "Report on the Phenological Observations for 1903." He stated that, taken as a whole, the year had been warm, very wet, and sunless. As affecting vegetation the most noteworthy meteorological features were the severity of the April frosts ; the three weeks of dry, warm and sunny weather which occurred towards the middle of an otherwise cold, rainy and gloomy summer ; and the excessive and persistent rainfall in October. Owing to the mildness of the winter and early spring wild plants flowered in advance of their average dates until about May, after which time only backward dates were recorded. In no previous year since the present series of reports was first instituted in 1891 have such spring migrants as the swallow, cuckoo and nightingale been so late in reaching our shores. The yield of wheat, barley, potatoes, turnips and swedes were somewhat under the average, but all the other farm crops yielded well, especially those of hay and beans, which were unusually abundant. On account of the wet and protracted harvest most of the grain of the cereals was more or less discoloured, while potatoes were almost everywhere much diseased. Throughout the country this was one of the most disastrous years for fruit ever known. In fact, the only fruit crop which gave anything like an average yield was that of strawberries.

An interesting discussion followed the reading of this report, in which the President, Mr. F. Campbell Bayard, Mr. C. Harding, Mr. A. Brewin, Mr. Baldwin Latbam, Mr. F. Druce, Mr. W. B. Tripp, Mr. R. H. Curtis, Mr. J. E. Clark, Mr. J. Hopkinson, and Dr. H. R. Mill took part, and Mr. E. Mawley replied.

Mr. W. H. Dines read a paper on "Observations by means of kites at Crinan in the summer of 1903." These observations were carried out by Mr. Dines under the auspices of a joint Committee of the Royal Meteorological Society and of the British Association, the Government Grant Committee of the Royal Society providing funds for the hire of a vessel for the purpose. The author, after describing various improvements which he had effected in the kites, stated that the weather last summer was most unfavourable for kite flying, as not only was there heavy rainfall, but gales were of frequent occurrence. Repeatedly a kite was carried up a thousand feet or more in a few minutes, or dropped the same height by a convection current. On August 20th a thunderstorm came on suddenly, when

the kite was at a considerable altitude. Mr. Dines's account of this storm is as follows:—

“I should not deliberately send up a kite during a thunder-storm, and was therefore the more pleased, when accidentally surprised by one, to recover the instruments safely. There is, however, nothing in any way peculiar about the chart, the temperature gradient being close to its average value. The kite when the first flash of lightning occurred was at a height of 4550 ft., 8230 ft. of wire being out, and we had little expectation of getting it back. Full steam was turned on, and the engine left to pull in the wire as fast as it could, since electrical indications could decidedly be felt by any one touching the steam valve. During the winding in, what at first appeared to be a squall overtook the vessel, the appearance being that of a definite wall, behind which nothing could be seen except the white tops of a few breaking waves. It was, however, only rain and hail, and mist, produced by the splashing of the rain and hail on the sea. As it passed the vessel the water ran down the deck in sheets, and I do not think I have ever seen rain of such intensity. Some difficulty was experienced with the kite when it was near the vessel, owing to the fitful character of the wind, which several times dropped entirely, and allowed the wire to become slack. No hail occurred at Crinan, some five miles to the north-east, but thunder and very heavy rain. The thunder was not of a severe character or very frequent, but there were several flashes of lightning less than a mile distant. The chart shows that rain of an exceptional character and hail may occur under normal conditions of temperature gradient near the surface. It would have been interesting to have had records from the higher strata.”

The results of the observations show that in August 1903 the mean temperature gradient for the first 5000 feet was  $3^{\circ}2$  per 1000 feet. This is substantially the same as that obtained during the preceding summer although the conditions of weather were different.

The President, Dr. W. N. Shaw, Mr. J. Hopkinson, Dr. R. H. Scott, Mr. J. E. Clark, and Mr. W. Marriott took part in the discussion on this paper, and Mr. Dines replied.



## Correspondence.

To the Editor of Symons's Meteorological Magazine.

## ATMOSPHERIC PRESSURE AND CLIMATE.

I WAS much interested in reading the article by Mr. Bonacina in the February number, and fully agree with him as to the important influence that the position of the isobars has upon climate, but I should prefer to put the statement in the form "prevailing winds" instead of "isobars," although of course if we know one we can infer the other. I should like, however, to ask his authority for the supposition that if the conditions were anticyclonic the mean temperature of January at Greenwich would be 20° F. instead of 37°. Unless "anticyclonic" is to be taken as meaning a north-easterly wind, a meaning that I think it often incorrectly bears, the supposition is not at all in accordance with observational results. As a general rule if a frost in the south of England is of exceptional length and severity it is accompanied by a barometer below the mean (*Quarterly Journal R. Met. Soc.*, Vol. 23, page 239); also, the mean temperature of the days at Greenwich in the winter on which the barometer is much above its usual level—viz., above 30.20 in.—comes out for the 50 years 1841—1890 as 38.3 F., a value close to the mean. (*Quarterly Journal R. Met. Soc.* Vol. 25, page 33.) These facts, and that they are facts any one who will take the trouble may verify for himself, are utterly antagonistic to the idea that anticyclonic conditions are accompanied by exceptional cold in the British Isles. No doubt an anticyclone situated over Scandinavia or Iceland produces cold in England, and an anticyclone over France or Spain produces warmth; but I see no reason why the one condition rather than the other should be described as anticyclonic conditions over the British Isles.

W. H. DINES.

## THE STUDY OF SUNSPOT CYCLES.

I HAVE read Mr. H. H. Clayton's letter and 11-year sunspot cycle scheme with interest. The criticisms as to the maxima and year-joining I agree with after more application of the table. The former differ for the reason indicated rather than expressly said in my foot note. I took the years with "unsmoothed" maxima for the months August—October, on which I was mainly working. But I conclude now that, though this and the extra year-joining were more accurate in theory, they are not needed in practice, and in any fresh investigation I should use the simpler series and the "smoothed" maxima and minima that apply to the whole year.

J. EDMUND CLARK.

### SNOW FALLS EIGHTY YEARS AGO.

WITH regard to the severe winters of eighty years ago, you may like to make a note of some records in our Sturminster Marshall Churchwarden's books. I may say that the Church consists of nave and north aisle. The snow would accumulate in the valley between the two roofs.

|                                               |     |
|-----------------------------------------------|-----|
| 1820. Jan. 7.—Wm. Cox and F. Everett.         |     |
| Throwing snow off the Church, 2 days each ... | 8s. |
| Dec. 23.           do.           do.          | 6s. |
| 1823. March 25.—Throwing snow, &c. ...        | 4s. |

Perhaps other churchwardens' books might give information of bygone years before rain gauges.

I may say that in the last 25 years we have only had snow thrown off about once or twice, and the sexton has done that as part of his ordinary work, so I imagine these must have been very heavy falls.

JAMES CROSS.

*Bailie House, Wimborne, 18th Feb., 1904.*

### THUNDERSTORM AT BROUGHTON-IN-FURNESS,

February 12th, 1904.

REAL thunderstorms so rarely occur near this station that a short account of one that occurred on February 12th may be of interest.

Clouds gathered towards 10 p.m., and for an hour or more after that there were pretty frequent flashes of vivid reflected lightning, which lit up most strongly the low hills to the S.E., over which they seemed to play. About 11.35 p.m. some loud peals of thunder were heard, having a very peculiar rolling and continuous sound for 30 seconds or more at a time, with very short intervals between the peals; a few fitful gusts of wind sprang up about this time and died away again after blowing for a minute or two. About 11.45 p.m. a strange hissing and rushing sound of wind was heard in the distance to the S., lasting for a minute or two and increasing in intensity and volume as the wind apparently came nearer. This sound was sufficiently peculiar to arrest the attention of all who heard it. Perhaps it was due to falling hail. Then, all at once, with terrific fury the storm was on us: blinding flashes of lightning, crashing peals of thunder, and hailstones beating on the glass with such violence that one could scarcely be heard when speaking; this continued incessantly for twelve minutes or so, then the storm died away as quickly as it had arisen, and in ten more minutes all was calm and still.

CHAS. P. CHAMBERS.

*Orchard Head, Broughton-in-Furness.*

## OBSERVATIONS OF RAIN AND DUST AND EVAPORATION, EDINBURGH, 1903.

I SEND for your inspection monthly tables of rain and dust and soot fall for Edinburgh central district for 1903, with that of evaporation also deduced from observations by a 6 in. gauge in back garden. The fall of dust and soot was registered by an open dish or gauge of 74 square inches area, or  $8\frac{1}{2}$  inches square, and amounted to 17 ounces for the year, giving 32 oz. per square foot. This considerable increase of dust fall for 1903 over that of 1902, when it was only 2 oz. for  $8\frac{1}{2}$  in. gauge, consisted mostly of sand blown from the building operations carried on at the girls' school in George Square, and at the extension works of the University Union building, by south-westerly, westerly and north-westerly winds blowing across the garden. The rainfall was much greater than usual, nearly double that of 1902, or 30.032 in. compared with 16.227 in., owing to wintry weather in January, February and March, to summer rains in July and August, and equinoctial gales in September and October. The number of rainy days was 218, compared with 179 in 1902, owing to like occurrences.

As might have been expected, the amount of evaporation for 1903 was much decreased from that of 1902, or 11.970 in. from 13.540 in., due to the general cloudy weather prevailing, and the absence of sun's heat during the general wet state of the whole year.

A curious contrast between the rainfall and evaporation of common observation in small and large gauges is, that the small evaporators register more reduction in the water than the large ones, and that the large rain gauges register more increase in the rainfall than the small ones—in fact, just the opposite.

Rain gauges, in pursuance of these observations, would require to be not below a certain moderate area, and if too small in the mouth they would register less rain than naturally falls to the earth.

So in the case of evaporation; a small gauge is less objectionable for registering than a large one, but this regular action is liable to be influenced besides by material of construction, as one of glass evaporates much less water than one of metal.

W. G. BLACK, F.R.Met.Soc.

2, George Square, Edinburgh.

[The measurement of evaporation in small vessels containing a shallow layer of water is, we fear, too largely dependent on the material of which the vessel is composed to give results of great value. The experiments on evaporation, recorded from year to year in "British Rainfall," have shown the necessity of using large tanks so as to avoid the complications due to local heating, and the standard size, 6 feet square and 2 feet deep, seems to have secured this result.—ED. S.M.M.]

## LOW MAXIMUM TEMPERATURES.

THE winter which has just come to an end has been, meteorologically speaking, very commonplace; but it possessed one feature which was somewhat unusual, especially as the mean temperature ( $39^{\circ}\cdot 1$ ) was above the average ( $38^{\circ}\cdot 6$ ) for the last twenty years, for this locality; namely, the remarkable absence of high maximum temperatures.

The average number of days in winter, for the last twenty years, on which the *maxima* have touched  $50^{\circ}$  is 18·5; whereas for the winter just over, there were only seven days on which  $50^{\circ}$  was reached, viz. :—one day in December, and three each in January and February.

There have only been two winters during the past twenty years in which there have been fewer maxima of  $50^{\circ}$ , namely, 1887-8 with five days, and 1885-6 with four, even the very severe winters of 1894-5 and 1890-1 had respectively eight and nine, while 1893-9 had forty-four, 1902-3 thirty-four, 1897-8 twenty-six, and 1900-1 twenty-four days with maxima of  $50^{\circ}$  and upwards.

Is it not probable that the saturated condition of the soil, owing to the abnormally heavy rainfall of the past fourteen months, may be the cause of the absence of high maxima during a winter which in every other respect must be characterized as having been a mild one?

H. K. S. ROGERS.

26, Charlton Road, Blackheath, S.E., 6th March, 1904.

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## GRADUATION OF RAIN GLASSES.

NOW that our rain gauges are in such unceasing use, may I trespass upon your space to make a suggestion.

It is that it would be of much help to observers if the meteorological instrument makers would slightly alter the form in which the scale of the measuring glasses is at present engraved.

As now inscribed on the glass a very careful scrutiny is necessary, and the reading has often to be checked both upwards and downwards. If on the *left* hand of the vertical scale the fives were distinctly shown by a side line of half-an-inch (ordinary measure)—say, for example, the 15, 25, 35, and so on—the tens could be given in a somewhat similar manner and rather bolder on the *right* hand side of the scale—for example, the 20, 30, 40, etc. An additional safeguard against any error of level when the reading is taken might also be added, viz., (without having a full double scale) a straight line (or dash stroke) engraved for each hundredth on the *opposite* side of the measuring glass, the “fives” and “tens” having longer strokes.

If this suggestion should seem feasible, and be endorsed by the weight of your approval, one might hope before long that our rain

glasses would be both quicker and more certain in being read accurately.

One would like to add how often it happens that the half-inch is very slightly exceeded—in which case a scale extended to 60 would be found very convenient. Beyond that it would be imprudent to go, for it might lead to greater chance of breakage of the slenderer and longer glass.

#### A RAINFALL OBSERVER OF OVER A QUARTER OF A CENTURY.

[We shall be glad to have the opinion of observers on this subject.—ED. S.M.M.]

### REVIEWS.

*Examen de la méthode de la prédiction du temps de* [Examination of the method of weather forecasts of] M. N. DEMTSCHINSKY, par A. KLOSSOVSKY. Odessa, 1903. Size 9 × 6½. Pp. 74. Plates.

IN this Magazine for May, 1901, (vol. 36, p. 53), we applied the simple test of comparing the curves of temperature and pressure predicted by M. Demchinsky for Aberdeen and Valencia for April, 1901, with the curves showing the actual facts as they occurred, and we summed up our conclusions in the words, "practically the forecasts as a whole appear to us to be valueless." M. Demchinsky has continued to apply his theory of lunar action to the prediction of weather, and from his influential position in Russia as a personal friend of the Tsar his views have naturally attracted much attention and his predictions are regarded by many people as of great importance. In the memoir under review Professor Klossovsky of the University of Odessa has examined both the theories and the predictions of the clever Russian engineer with remarkable acuteness and erudition, and after an exhaustive discussion of the whole matter, with comparative curves of prediction and fulfilment for several stations, and for several years at each station, he sums up in a series of propositions, which we think English readers will be glad to see translated in full. It is pointed out that M. Demchinsky claims that on certain "nodal days" of the lunar year the curves of temperature of any number of lunar years cut each other at the same point—in other words, that the temperature on a "nodal day" is the same in every successive lunar year, however different the temperature of the various years may be on other days. He also claims that the climate of any particular season bears an ascertainable relation to the climate of the succeeding season at the same or at some other place.

Professor Klossovsky, on the other hand, says:—

1.—The verifications made for Odessa, Kieff and Moscow have not revealed any nodal days in the march of the curves of pressure, temperature, cloud or

rain. Consequently, the "ideal line" does not exist, unless it be the mean annual curve for the lunar year.

2.—The relation between the pressure and temperature of winter and summer holds good in fifty cases out of one hundred; in other words, it is equal to the probability of heads or tails turning up in pitch and toss. The process by which M. Demchinsky fills up the internodal parts of his thermal curves in winter and of the general march of the barometer remains unknown to us; and the same is true for the prediction of the other elements of climate.

3.—The law according to which certain days of "similar years" should have the same temperature is not justified even at Warsaw. The elements of weather have a very varied appearance in the course of "similar years," even in those which are separated by a cycle of 19 years.

4.—The formula of Tippenhauer and the application of it made by M. Demchinsky only reveal a succession of serious misunderstandings.

5.—The assertion that equal temperatures correspond to equal amounts of work is in complete contradiction to all the principles of modern science.

6.—All the predictions hitherto published have succeeded or failed according to the same probability by which heads or tails turn up in pitch and toss.

7.—M. Demchinsky's system in its entirety is without a single new idea, the deductions are based on the method of means, that of the earliest stage of meteorology.

Professor Klossovsky concludes by saying that if, after the proofs he has adduced, M. Demchinsky persists in his errors, he ought to submit his views to a special committee to be nominated by the International Meteorological Committee, and pending the decision of this tribunal, desist from publishing his predictions either in "Climat" or in the press.

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*Weather Folk-Lore and Local Weather Signs.* Prepared under the direction of WILLIS L. MOORE by EDWARD B. GARRIOTT, Professor of Meteorology. Washington, 1903. Size 9 x 6. Pp. 154. Plates.

THE title of the book is English, not so the title of the author, for the British Isles do not boast a single professor of Meteorology, nor does the science receive with us more than a semi-contemptuous recognition in any seat of learning. The first part of this interesting memoir contains a selection of the weather-lore of all countries—most of which are familiar to us in Mr. Inwards' delightful collection—carefully arranged, with notes as to their applicability to the weather of the United States. Long range weather-forecasts in relation to sun-spot cycles and lunar influence are also referred to. Two-thirds of the book are occupied by summaries of local weather signs reported by the Weather Bureau observers. They deal with sequences of weather, relation of winds to rainfall and other conditions, periods of frost, &c. These must be of considerable utility to residents in the districts in question, but the utility is practically destroyed by the unscientific arrangement, which is alphabetical under the names

of towns. Suppose anyone were anxious to know the weather signs of the State of New York, he could only find them scattered amongst others under the names of Albany, Binghamton, Buffalo, Ithaca, New York, Oswego, and Rochester. For such a list a simple geographical arrangement of the data, with a key-map as well as an index of towns, ought unquestionably to have been adopted.

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*Magnetic and Meteorological Observations made by the "Southern Cross" Antarctic Expedition, 1898—1900, under the direction of C. E. Borchgrevink.* London: Published by the Royal Society of London. 1902. Size 12 × 9. Pp. 112. Chart and Plates.

THE magnetic observations made by Mr. Bernacchi and Lieutenant Colbeck, both of whom are again in the Antarctic regions as members of the British expeditions, on board the "Discovery" and "Morning," have been reduced and discussed by Dr. Charles Chree, of Kew.

The meteorological observations were reduced, under the superintendence of Dr. W. N. Shaw, at the Meteorological Office, and they are furnished with an introduction and notes by Mr. Bernacchi. No doubt owing to the absence of the latter when the proofs were passed for press, the names of several of the members of the staff of the "Southern Cross" have suffered somewhat from the printer. Thus we read Dr. Herlof Klovstad, Mr. Nicolas Hanson, and Mr. A. Tongner, instead of Dr. Herluf Klövstad, Mr. Nicolai Hanson, and Mr. A. Fougner.

The observations are set out in detail as taken at two hourly intervals at the land station near Cape Adare ( $71^{\circ}18'S.$ ,  $170^{\circ}9'30''E$ ), from March 3rd, 1899, to January 29th, 1900, and these are then summarised to show the mean monthly conditions. Monthly wind-roses are given, which show in a very striking way the preponderance of south-easterly winds on the shores of the Antarctic continent, and the almost entire absence of wind from points between north-west and south-west. This, combined with the records of earlier, and now of later expeditions also, proves that the zone of the Brave West Winds lies far to the north of Antarctica, and promises good results to any expedition which, breaking away from a tradition for which there is no justification, will attempt a circumnavigation from east to west in high latitudes. The question of Antarctic winds is discussed by Mr. Bernacchi, who gives interesting particulars of some of the terrific storms which frequently made the lives of the explorers miserable.

The meteorological log of the "Southern Cross" in Antarctic waters is given in a condensed form, and the volume is valuable as a record of data secured in very arduous conditions and requiring much care before they could be presented in a form available for reference.

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*The State of the Ice in the Arctic Seas, 1903. Special print of the Nautical Meteorological Annual of the Danish Meteorological Institute. Copenhagen, 1904. Size  $12\frac{1}{2} \times 9\frac{1}{2}$ . Pp. xxiv. Maps.*

THIS prompt and useful publication gives for each month, from April to August, a chart showing the condition of the ice in the whole Arctic Sea, so far as it can be ascertained from the reports of vessels trading to those inhospitable regions. The conclusions drawn from a careful study of all the available data are that the temperate seas have been invaded by about the normal quantity of drifting ice during 1903, but that the Labrador current flowing down past the Banks of Newfoundland carried with it an unusual number of icebergs, many of them being of exceptional size. In fact, on the routes of the trans-Atlantic steamers there has not been so much ice to be seen for many years. This condition of things had been foreseen and predicted a year ago on account of the small number of bergs liberated in 1902; but there is no indication to be drawn from last year as to the probable condition of the ocean routes in 1904.



## METEOROLOGICAL NEWS AND NOTES.

THE INTERNATIONAL COUNCIL FOR THE STUDY OF THE SEA met for the third time from February 22nd to 27th at Hamburg, when the physical and meteorological aspects of the work were represented by the following delegates and experts:—Belgium, Professor Gilson of Louvain; Denmark, Mr. Martin Knudsen of Copenhagen; Finland, Professor Homén of Helsingfors; Germany, Professor Krümmel of Kiel; Great Britain, Dr. H. R. Mill of London; Holland, Dr. Wind of the Royal Meteorological Institute de Bilt; Norway, Professor Fridtjof Nansen of Christiania; Russia, Professor Knipovich of St. Petersburg; Sweden, Professor Pettersson of Stockholm. New forms of apparatus for measuring the direction and velocity of currents at various depths in the sea were exhibited by Professors Nansen and Pettersson, the latter also showing improved deep-sea thermometers. The Council recommended that current measurements be made a part of the routine of the seasonal cruises of the various countries, and also that an effort be made to extend the admirable system of observations of surface temperature made on board the steamers of the Dutch lines to all parts of the North Sea. The Senates of Hamburg and of Bremen, and the Directors of the Hamburg-American line, entertained the International Council in princely style during the meeting.

DAILY KITE ASCENTS now form part of the routine of the meteorological work at the Deutsche Seewarte in Hamburg as well as at the Aeronautical Institute in Berlin. The temperatures, humidities, and wind velocities observed at various heights, up to 7,000 or 8,000 feet in favourable conditions, are published daily in the weather reports. The number of kites used depends on the strength of the wind, and there are comparatively few days when an ascent of some kind is impossible. The German meteorological authorities make a special point of recording the observations from high-level observatories, and they hope at an early date to supplement the continental records with those from Ben Nevis.

MR. W. C. NASH has, we learn from *The Observatory*, retired, in accordance with the rules of the Admiralty Service, from the post of Superintendent of the Magnetical and Meteorological Department at Greenwich Observatory. Mr. Nash was attached to this department when he joined the staff of the Observatory in 1856, and assisted Mr. Glaisher in much of his work, including some of the balloon ascents. He succeeded Mr. William Ellis as Superintendent of the Department in 1894.

LE TEMPS QU'IL FAIT—which may be Englished as *The Weather we have*—is the title of a new monthly magazine designed for the popularization of meteorology, and published at Mons in Belgium. The first three numbers have already appeared, and the cover at once attracts attention by its artistic if somewhat wintry appearance. The contents are designed for the non-scientific person interested in observing the weather.

THE PATH OF THE AIR IN CYCLONES is investigated in a recent number of the *Meteorologische Zeitschrift* by Dr. W. Meinardus, who proves by mathematical reasoning that the trajectories of particles of air in an unsymmetrical moving cyclone correspond very closely with the actual trajectories found by Dr. W. N. Shaw to be followed by the air in particular cases. Dr. Meinardus mentions that Dr. Assmann has devised a method by which a balloon may be caused to float in any desired stratum of air and trace out its path on the surface of the ground by dropping some easily recognisable material continuously for a considerable time.



RAINFALL AND TEMPERATURE, FEBRUARY, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.   |                             |                       |        | Days on which<br>0.1 or more fell. | TEMPERATURE. |        |      |        | No. of Nights below 32°. |       |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------|-----------------------|--------|------------------------------------|--------------|--------|------|--------|--------------------------|-------|
|        |                                                                                                                                      | Total Fall. | Diff. from average, 1890-9. | Greatest in 24 hours. |        |                                    | Max.         |        | Min. |        | Shade                    | Grass |
|        |                                                                                                                                      |             |                             | Depth.                | Date.  |                                    | Deg.         | Date.  | Deg. | Date.  |                          |       |
| I.     | London (Camden Square) ...                                                                                                           | 2.58        | + 1.11                      | .48                   | 9      | 19                                 | 54.3         | 20     | 27.9 | 29     | 8                        | 24    |
| II.    | Tenterden.....                                                                                                                       | 2.94        | + 1.24                      | .63                   | 9      | 21                                 | 51.0         | 20, 21 | 25.5 | 29     | 12                       | 21    |
| „      | Hartley Wintney .....                                                                                                                | 3.43        | + 1.80                      | .57                   | 12     | 23                                 | 54.0         | 20a    | 27.0 | 27b    | 15                       | 19    |
| III.   | Hitchin ..                                                                                                                           | 2.86        | + 1.40                      | .55                   | 9      | 17                                 | 53.0         | 21     | 25.0 | 28     | 17                       | ...   |
| „      | Winslow (Addington) .....                                                                                                            | 3.18        | + 1.72                      | .78                   | 9      | 17                                 | 53.0         | 21     | 24.0 | 29     | 14                       | 23    |
| IV.    | Bury St. Edmunds (Westley) ..                                                                                                        | 2.81        | + 1.27                      | .50                   | 9      | 18                                 | 54.5         | 21     | 25.0 | 23     | ...                      | ...   |
| „      | Brundall .....                                                                                                                       | 3.17        | + 1.65                      | .38                   | 17     | 24                                 | 55.0         | 21     | 26.2 | 28     | 9                        | 18    |
| V.     | Alderbury .....                                                                                                                      | 4.10        | + 2.02                      | .67                   | 12     | 24                                 | 47.0         | 20     | 23.0 | 28, 29 | 16                       | ...   |
| „      | Winterborne Steepleton ..                                                                                                            | 6.49        | ...                         | .96                   | 2      | 22                                 | 49.7         | 20     | 21.4 | 29     | 10                       | 15    |
| „      | Torquay (Cary Green) .....                                                                                                           | 5.93        | ...                         | .89                   | 12     | 22                                 | 53.9         | 22     | 32.3 | 19     | 0                        | 14    |
| „      | Polapit Tamar [Launceston] ..                                                                                                        | 7.59        | + 4.98                      | 1.14                  | 14     | 24                                 | 51.1         | 21     | 23.2 | 29     | 11                       | 12    |
| VI.    | Stroud (Upfield) .....                                                                                                               | 4.40        | + 2.48                      | .73                   | 9      | 22                                 | 49.0         | 20     | 26.0 | 28     | 14                       | ...   |
| „      | Church Stretton (Woolstaston) ..                                                                                                     | 4.08        | + 2.08                      | .42                   | 9      | 23                                 | 50.5         | 20, 21 | 20.0 | 29     | 20                       | 20    |
| „      | Bromsgrove (Stoke Reformatory) ..                                                                                                    | 2.86        | + 1.44                      | .37                   | 9      | 20                                 | 48.0         | 20, 21 | 21.0 | 28     | 17                       | ...   |
| VII.   | Boston .....                                                                                                                         | 2.31        | + .96                       | .42                   | 17     | 14                                 | 50.0         | 20     | 27.0 | 27     | ...                      | ...   |
| „      | Bawtry (Hesley Hall) .....                                                                                                           | 2.92        | + 1.47                      | 1.21                  | 3      | 20                                 | 50.0         | 19, 20 | 24.0 | 29     | 17                       | ...   |
| „      | Derby (Midland Railway)...                                                                                                           | 2.80        | + 1.35                      | .65                   | 3      | 20                                 | 54.0         | 20     | 24.0 | 28     | 17                       | ...   |
| VIII.  | Bolton (The Park) .....                                                                                                              | 3.82        | + 1.38                      | .54                   | 3      | 20                                 | 50.2         | 21     | 23.2 | 29     | 10                       | 22    |
| IX.    | Wetherby (Ribston Hall) ...                                                                                                          | 3.34        | + 1.90                      | .53                   | 3      | 22                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| „      | Arncliffe Vicarage .....                                                                                                             | 5.18        | + .36                       | .88                   | 12     | 23                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| „      | Hull (Pearson Park) .....                                                                                                            | 2.18        | + .46                       | .58                   | 3      | 23                                 | 54.0         | 21     | 29.0 | 29     | 12                       | 26    |
| X.     | Newcastle (Town Moor) ...                                                                                                            | 2.60        | + 1.13                      | .33                   | 3      | 19                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| „      | Borrowdale (Seathwaite) ...                                                                                                          | 10.13       | + 1.64                      | 2.44                  | 13     | 16                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 6.21        | + 3.32                      | .76                   | 9      | 22                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| „      | Haverfordwest (High St) ..                                                                                                           | 6.10        | + 2.76                      | .94                   | 25     | 21                                 | 50.8         | 12, 20 | 28.0 | 29     | 5                        | 18    |
| „      | Aberystwith (Gogerddan) ..                                                                                                           | 4.59        | + 1.44                      | .60                   | 19     | 17                                 | 51.0         | 21, 23 | 20.0 | 29     | 17                       | ...   |
| „      | Llandudno .....                                                                                                                      | 3.00        | + 1.05                      | .60                   | 3      | 22                                 | 53.0         | 21     | 25.5 | 29     | 2                        | ...   |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 2.89        | — .77                       | .76                   | 12     | 15                                 | 49.0         | 22     | 21.0 | 19, 29 | 12                       | ...   |
| XIII.  | Edinburgh (Royal Observy.) ..                                                                                                        | 2.38        | ...                         | .40                   | 5      | 20                                 | 43.4         | 21     | 22.1 | 29     | 12                       | 22    |
| XIV.   | Colmonell.....                                                                                                                       | 3.80        | + .39                       | .90                   | 19, 25 | ...                                | 50.0         | 19     | 24.0 | 1      | 10                       | ...   |
| XV.    | Tighnabruaich.....                                                                                                                   | 5.44        | ...                         | 1.14                  | 24     | 15                                 | 46.0         | 20     | 26.0 | 14c    | 16                       | 18    |
| „      | Mull (Quinish).....                                                                                                                  | 5.47        | + 1.08                      | .83                   | 25     | 20                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 2.92        | + .14                       | .44                   | 3      | 15                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| „      | Dundee (Eastern Necropolis) ..                                                                                                       | 4.25        | + 2.12                      | .95                   | 6      | 20                                 | 46.9         | 20     | 25.0 | 29     | 17                       | ...   |
| XVII.  | Braemar .....                                                                                                                        | 1.44        | — 1.14                      | .34                   | 12     | 19                                 | 42.2         | 27     | 10.8 | 11     | 24                       | 29    |
| „      | Aberdeen (Cranford) .....                                                                                                            | 4.07        | + 1.66                      | .65                   | 12     | 21                                 | 47.0         | 12, 13 | 25.0 | 16, 18 | 16                       | ...   |
| „      | Cawdor (Budgate) .....                                                                                                               | 2.29        | + .35                       | .40                   | 13     | 19                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| XVIII. | Glencarron Lodge .....                                                                                                               | 4.34        | — 2.98                      | 1.39                  | 19     | 22                                 | 46.1         | 28     | 20.2 | 19     | 19                       | ...   |
| „      | Bendamph .....                                                                                                                       | 3.76        | — 2.88                      | 1.00                  | 19     | 16                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| XIX.   | Dunrobin Castle .....                                                                                                                | 3.78        | + 1.36                      | .87                   | 21     | 16                                 | 49.5         | 27     | 24.0 | 19     | 18                       | ...   |
| „      | Castletown .....                                                                                                                     | 4.40        | ...                         | .44                   | 21     | 25                                 | 42.0         | 19     | 23.0 | 16, 17 | 22                       | ...   |
| XX.    | Killarney .....                                                                                                                      | 5.72        | + 1.51                      | .59                   | 18     | 26                                 | 58.0         | 12     | 29.0 | 1      | ...                      | ...   |
| „      | Waterford (Brook Lodge)...                                                                                                           | 6.39        | + 3.48                      | .77                   | 29     | 25                                 | 53.0         | 20     | 25.0 | 1      | 9                        | ...   |
| „      | Broadford (Hurdlestown) ...                                                                                                          | 4.89        | + 2.67                      | .75                   | 28     | 25                                 | 49.0         | 20     | 28.0 | ...    | 15                       | ...   |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 3.75        | + 1.20                      | .52                   | 12     | 24                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| „      | Dublin (Fitz William Square) ..                                                                                                      | 3.31        | + 1.36                      | .46                   | 12     | 17                                 | 56.5         | 21     | 30.0 | 17     | 5                        | 16    |
| XXII.  | Ballinasloe .....                                                                                                                    | 5.17        | + 2.74                      | .56                   | 29     | 28                                 | 67.0         | 19, 20 | 20.0 | 1      | 23                       | ...   |
| „      | Clifden (Kylemore House) ..                                                                                                          | 8.04        | + 2.13                      | 1.41                  | 28     | 24                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| XXIII. | Seaforde .....                                                                                                                       | 4.34        | + 1.55                      | .68                   | 12     | 22                                 | 51.0         | 21     | 24.0 | 9      | 15                       | 17    |
| „      | Londonderry (Creggan Res.) ..                                                                                                        | 2.78        | + .07                       | .39                   | 25     | 18                                 | ...          | ...    | ...  | ...    | ...                      | ...   |
| „      | Omagh (Edenfel).....                                                                                                                 | 5.40        | + 2.80                      | .95                   | 12     | 21                                 | 50.0         | 19, 21 | 24.0 | 10, 16 | 16                       | 20    |

Bandamph (January) ..... 12.58 + 2.98 1.98 10 22 ... ..

+ Shows that the fall was above the average; — that it was below it. a and 21, 22. b and 28 29. c and 18, 29.

## SUPPLEMENTARY RAINFALL, FEBRUARY, 1904.

| Div.  | STATION.                       | Rain.<br>inches | Div.   | STATION.                     | Rain.<br>inches |
|-------|--------------------------------|-----------------|--------|------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....    | 3·92            | XI.    | New Radnor, Ednol .....      | 6·01            |
| „     | Sheppey, Leysdown .....        | 2·33            | „      | Rhayader, Nantgwilt ...      | 7·38            |
| „     | Hailsham .....                 | 3·56            | „      | Lake Vyrnwy .....            | 6·77            |
| „     | Crowborough .....              | 3·96            | „      | Ruthin, Plâs Drâw.....       | 4·18            |
| „     | Ryde, Beldornie Tower.....     | 3·23            | „      | Criccieth, Talarvor.....     | 3·25            |
| „     | Einsworth, Redlands.....       | 3·60            | „      | Anglesey, Lligwy .....       | 3·24            |
| „     | Alton, Ashdell .....           | 4·36            | „      | Douglas, Woodville .....     | 4·74            |
| „     | Newbury, Welford Park ...      | 3·72            | XII.   | Stoneykirk, Ardwell House    | 3·84            |
| III.  | Harrow Weald .....             | 2·58            | „      | Dalry, Old Garroch .....     | 5·32            |
| „     | Oxford, Magdalen College..     | 2·84            | „      | Langholm, Drove Road....     | 4·09            |
| „     | Banbury, Bloxham... ..         | 4·54            | „      | Montaive, Maxwellton House   | 4·20            |
| „     | Pitsford, Sedgebrook .....     | 3·41            | „      | Lilliesleaf, Riddell .....   | 2·97            |
| „     | Huntingdon, Brampton.....      | 2·91            | XIII.  | N. Esk Reservoir [Penicuik]  | 3·85            |
| „     | Wisbech, Bank House .....      | 2·28            | XIV.   | Maybole, Knockdon Farm..     | 2·90            |
| IV.   | Southend .....                 | 1·90            | „      | Glasgow, Queen's Park .....  | 2·23            |
| „     | Colchester, Lexden.....        | 2·16            | XV.    | Inveraray, Newtown .....     | 6·28            |
| „     | Saffron Waldon, Newport...     | 3·25            | „      | Ballachulish, Ardsheal ..... | 7·64            |
| „     | Rendlesham Hall .....          | 2·18            | „      | Campbeltown, Redknowe...     | 3·64            |
| „     | Swaffham .....                 | 3·15            | „      | Islay, Eallabus .....        | 4·07            |
| „     | Blakeney .....                 | 3·02            | XVI.   | Dollar .....                 | 3·79            |
| V.    | Bishop's Cannings .....        | 3·13            | „      | Balquhider, Stronvar .....   | 6·32            |
| „     | Ashburton, Druid House .....   | 9·51            | „      | Coupar Angus Station .....   | 3·70            |
| „     | Okehampton, Oaklands.....      | 7·84            | „      | Blair Atholl .....           | 2·58            |
| „     | Hartland Abbey .....           | 5·22            | „      | Montrose, Sunnyside.....     | 3·18            |
| „     | Lynmouth, Rock House ...       | 5·86            | XVII.  | Alford, Lynturk Manse ...    | 4·21            |
| „     | Probus, Lamellyn .....         | 7·20            | „      | Keith, H. R.S.....           | 3·35            |
| „     | Wellington, The Avenue ...     | 5·50            | XVIII. | Fearn, Lower Pitkerrie.....  | 2·21            |
| „     | North Cadbury Rectory ..       | 4·21            | „      | S. Uist, Askernish .....     | 3·81            |
| VI.   | Clifton, Pembroke Road ...     | 4·09            | „      | Invergarry .....             | 4·39            |
| „     | Moreton-in-Marsh, Longboro'    | 5·03            | „      | Aviemore, Alvie Manse.....   | 1·34            |
| „     | Ros, The Graig .....           | 4·42            | „      | Loch Ness, Drumnadrochit.    | 2·16            |
| „     | Shifnal, Hatton Grange.....    | 3·50            | XIX.   | Invershin .....              | 3·86            |
| „     | Wem Rectory .....              | 3·13            | „      | Altnaharra .....             | 3·06            |
| „     | Cheadle, The Heath House.      | 3·11            | „      | Bettyhill .....              | 2·53            |
| „     | Coventry, Kingswood .....      | 3·42            | „      | Watten, H. R.S.....          | 3·01            |
| VII.  | Market Overton .....           | 3·51            | XX.    | Cork, Wellesley Terrace ...  | 5·78            |
| „     | Market Rasen .....             | 2·55            | „      | Darrynane Abbey .....        | 7·51            |
| „     | Worksop, Hodsock Priory..      | 3·23            | „      | Glenam [Clonmell] .....      | 5·81            |
| VIII. | Neston, Hinderton.....         | 3·28            | „      | Ballingarry, Hazelfort ..... | 4·10            |
| „     | Southport, Hesketh Park...     | 3·81            | „      | Miltown Malbay.....          | 6·09            |
| „     | Chatburn, Middlewood .....     | 4·14            | XXI.   | Gorey, Courtown House ...    | 4·28            |
| „     | Duddon Valley, Seathwaite Vic. | 6·75            | „      | Moynalty, Westland .....     | 4·25            |
| IX.   | Langsett Moor, Up. Midhope     | 6·27            | „      | Athlone, Twyford .....       | 5·49            |
| „     | Baldersby .....                | 2·46            | „      | Mullingar, Belvedere.....    | 5·24            |
| „     | Scalby, Silverdale .....       | 3·01            | XXII.  | Woodlawn .....               | 5·60            |
| „     | Ingleby Greenhow Vicarage      | 3·06            | „      | Westport, Murrisk Abbey..    | 7·25            |
| „     | Middleton, Mickleton .....     | 1·80            | „      | Crossmolina, Ennisceoe ..... | 7·53            |
| X.    | Beltingham .....               | 2·21            | „      | Collooney, Markree Obsy...   | 4·47            |
| „     | Bamburgh .....                 | 2·55            | XXIII. | Enniskillen, Portora .....   | 5·21            |
| „     | Keswick, The Bank .....        | 5·13            | „      | Warrenpoint .....            | 3·23            |
| „     | Melmerby Rectory.....          | 2·95            | „      | Banbridge, Milltown .....    | 2·92            |
| XI.   | Llanfrechfa Grange.....        | 6·68            | „      | Belfast, Springfield .....   | 4·10            |
| „     | Treherbert, Tyn-y-waun ...     | 10·00           | „      | Bushmills, Dundarave .....   | 2·52            |
| „     | Llandovery, Tonn .....         | 4·57            | „      | Stewartstown .....           | 3·80            |
| „     | Castle Malgwyn .....           | 5·23            | „      | Killybegs .....              | 5·33            |
| „     | Llandefaelog-fach .....        | 5·47            | „      | Horn Head .....              | 3·51            |

Ryde, Beldornie Tower (January) ..... 2·97.

## METEOROLOGICAL NOTES ON FEBRUARY, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

## ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Un genial and lacking in sunshine, with frequent R and uniform temp. Slight frost during the last week with light S showers. Duration of sunshine 41·5 hours, and of R 57·1 hours. Mean temp. 39°·4, or 0°·4 below the average.

TENTERDEN.—Again wet, with much wind in the middle. The last week was drier with E. wind, but S at the close. Duration of sunshine 75 hours. Very low bar. from 8th to 11th, reading 28·68 in. on 9th.

SHEPPEY, LEYSDOWN.—Mild and unsettled until 23rd, then cold N.E. wind with frost, and about 6 inches of S from 27th to 29th. Terrific gale on 12th and strong gales on 8th, 9th and 21st. TS on 13th.

CROWBOROUGH.—The first three weeks were mild with R almost continuously, and the last week very cold with frost and S. H on 3 days, S on 6 days. Prevailing winds W. and S. till 22nd, then N. and E. Mean temp. 37°·4.

HARTLEY WINTNEY.—The cloud and gloom of the preceding month continued until the end of the third week, with R daily. The last week was brighter with more sun, cold E. wind and slight S showers. Ozone on 17 days with a mean of 4·0.

WINSLOW, ADDINGTON.—Except 1883 and 1900 the wettest February in 34 years. The last week was very cold, with a slight sprinkling of S.

PITSFORD, SEDGEBROOK.—Another wet, cold and gloomy month with constant slight S. R 1·42 in. above the average of 10 years. Mean temp. 36°·6.

COLCHESTER, LEXDEN.—Stormy till 14th, with R every day but one. Then colder and much drier with E. wind from 24th and traces of S.

BURY ST. EDMUNDS.—Only 3 days without R till 17th, with southerly winds. E. winds set in on 22nd with frosts and dry weather.

BRUNDALL.—Mean temp. 38°·9, or 0°·7 above the average of 20 years, but 5°·4 below that of February, 1903. Very damp and rainy for the first three weeks. Winterly at the close with S.

WINTERBORNE STEEPLTON.—R more than double the average of 11 years.

TORQUAY, CARY GREEN.—R 3·24 in. above the average. Mean temp. 42°·7, or 0°·4 below the average. Duration of sunshine 62·7 hours, or 18·9 hours below the average. Mean amount of ozone 5·9. Max. 9·0 on 13th with W. wind; min. 1·0 on 28th with E.N.E. wind.

ASHBURTON, DRUID HOUSE.—Excessive R, the total being 4·84 in. above the average of 38 years. This fall was exceeded in 1883, 10·10 in., and 1900, 11·07 in. The lowest falls in February were ·00 in. in 1895 and ·03 in. in 1891.

LYNMOUTH, ROCK HOUSE.—Colder than January with very heavy H storms.

WELLINGTON.—Abnormally wet, R falling every day, and at times very heavily. The total fall was almost double the average.

NORTH CADBURY.—Temp. about normal in all points, but the last week a good deal the coldest. The air was reeking with moisture till the last week when drying E. airs began.

CLIFTON, PEMBROKE ROAD.—Very wet, with R 1·60 in. above the average and frequent gales from S.W. Sharp frost on 28th and 29th and S or sleet on four days. T and L on the night of 12th.

ROSS, THE GRAIG.—Very wet till 17th, and very unpleasant weather most of the month. The meadows were saturated from the excess of R, but the Wye was not much flooded. Temp. near the average.

BOLTON.—Dull, changeable and humid, with low temp., particularly during the last 3 days. Mean temp. 36°·6, or 0°·8 below the average. Duration of sunshine 16·8 hours on 9 days, being 21·6 hours less than the average, and the lowest February record. S on 6 days, 2 inches falling on 15th and 5 inches on 25th.

SOUTHPORT.—Exceptionally wet and cloudy, the mean pressure being

exceedingly low. Mean temp.  $0^{\circ}\cdot9$  below the average. Duration of sunshine 28 hours below the average. The underground water level was remarkably high. Total depth of S  $4\cdot3$  in. E  $1\cdot81$  in. above the average.

**SEATHWAITE VICARAGE.**—Generally mild and rainy till the closing week, which was marked by the heaviest S and sharpest frost of the season.

**HULL, PEARSON PARK.**—Very dull, with E and frequently cold. Extremely cloudy throughout. S on 18th.

**LLANFRECHFA GRANGE.**—Mild till 15th, then frost at night. E rather unusually heavy, but in 1900 there was  $9\cdot31$  in., and in 1893  $6\cdot44$  in.

**LLANDOVERY.**—Cold, wet and changeable for the most part, with mean temp.  $39^{\circ}\cdot0$ . Violent storms with T from 12th to 14th, after which S, E and frost to 20th. Mild and wet to 25th, afterwards fairly dry and cold.

**HAVERFORDWEST.**—Remarkable for low max. temp., reaching  $50^{\circ}$  on 3 days only. Very wet from 8th to 10th, with bar. below 29 in. From 12th to 14th stormy and cold. Duration of sunshine 28·9 hours.

**ABERYSTWTH.**—Very cold and wet till the last few days, which were fine, with cold N.E. winds. Unseasonable throughout.

**DOUGLAS.**—Very wet, sunless and depressing. E fell on every day till 27th. Frost on 1st and on last two days. Temp. about the average. H on 11th; S on 3 days. Spring flowers were ruined by wet.

#### SCOTLAND.

**CARGEN [DUMFRIES].**—Sunless though dry. Vegetation was severely checked by cold E. wind in the last week.

**MAXWELTON HOUSE.**—Cold, wet and snowy, with a few very fine days. Mean temp.  $35^{\circ}$ , or  $5^{\circ}$  below the average. E  $1\cdot10$  in. above the average. Seven inches of S on 17th.

**MULL, QUINISH.**—Cold, wet and unsettled, with constant sudden changes.

**COUPAR ANGUS.**—Exceedingly wet and very mild. Persistent E during the first half, but no floods. Mean temp.  $43^{\circ}\cdot2$ , the highest for 25 years.

**ALTNAHARRA.**—Very fine and open, and upon the whole exceptionally mild.

**BETTYHILL.**—The E was light except for a day or two, and the weather generally frosty with a few bright warm days.

**WATTEN.**—Wet and squally and very changeable, with slight frosts and frequent storms of E, sleet and S.

**CASTLETOWN.**—The first part was very damp, with E. and S.E. winds and daily E or S.

#### IRELAND.

**CORK.**—E  $2\cdot34$  in. over the average, and mean temp.  $5^{\circ}\cdot0$  below the average. The city floods of 1st and 2nd were due to the diminished pressure over the ocean, S.E. wind blowing into the harbour, and the river swollen from the recent E. On 14th  $\cdot60$  in. of E fell in 9 hours.

**DARRYNANE ABBEY.**—The wettest February in 25 years, the fall being 76 per cent. above the average. The fall for January and February was 46 per cent. above the average.

**MILTOWN MALBAY.**—Very cold, stormy and wet, preventing all attempts at tillage, and winding up with a storm of S, sleet and E, which flooded the entire country. Much H; T, L, and stormy weather prevailed.

**DUBLIN, FITZWILLIAM SQUARE.**—Dull, cold, damp and rainy. Mean temp.  $40^{\circ}\cdot7$ . The bar. was persistently low in the week ending 13th, the mean for the seven days being only  $29\cdot035$  in. Sharp TS on the evening of 12th.

**COLLOONEY, MARKREE OBSERVATORY.**—Frequent S storms. T and L on one day. Gales on four days. Duration of sunshine  $41\cdot4$  hours.

**BELFAST, SPRINGFIELD.**—Rather an unpleasant month. The frost was not sufficient to benefit the land. The wettest February since 1894.

**OMAGH, EDENFEL.**—Raw, wet and unsettled almost without intermission, with E above and temp. below the average, and frequent strong winds, approaching but not reaching the violence of gales.

## Climatological Table for the British Empire, September, 1903.

| STATIONS.<br><br><i>(Those in italics are<br/>South of the Equator.)</i> | Absolute. |                 |          |       | Average. |      |               |           | Absolute.       |                   | Total Rain. |       | Aver.  |
|--------------------------------------------------------------------------|-----------|-----------------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|-------------|-------|--------|
|                                                                          | Maximum.  |                 | Minimum. |       | Max.     | Min. | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.      | Days. | Cloud. |
|                                                                          | Temp.     | Date.           | Temp.    | Date. |          |      |               |           |                 |                   |             |       |        |
| London, Camden Square                                                    | 83·7      | 2               | 38·1     | 17    | 67·6     | 50·8 | 52·0          | 83        | 121·8           | 35·1              | 2·64        | 13    | 5·3    |
| Malta                                                                    | 100·3     | 13              | 55·4     | 29    | 82·1     | 68·4 | 64·4          | 71        | 148·7           | 53·5              | 1·09        | 3     | 3·6    |
| Lagos, W. Africa                                                         | 85·0      | 21 <sup>a</sup> | 68·0     | 28    | 82·9     | 73·9 | 73·1          | 79        | 145·0           | 68·0              | 9·92        | 15    | ...    |
| Cape Town                                                                | 87·2      | 4               | 40·6     | 15    | 66·8     | 51·2 | 51·8          | 77        | ...             | ...               | 2·29        | 13    | 5·2    |
| Durban, Natal                                                            | 96·1      | 29              | 48·9     | 2     | 75·9     | 57·2 | ...           | ...       | 144·3           | ...               | ·62         | 7     | 3·7    |
| Mauritius                                                                | 80·5      | 19              | 55·4     | 9     | 76·5     | 62·0 | 58·2          | 70        | 143·7           | 45·3              | 1·66        | 20    | 5·8    |
| Calcutta                                                                 | 91·9      | 21              | 72·8     | 12    | 87·8     | 77·8 | 77·2          | 86        | 158·4           | 71·9              | 14·02       | 12    | 8·2    |
| Bombay                                                                   | 88·1      | 16              | 73·3     | 19    | 85·4     | 77·2 | 76·2          | 84        | 138·8           | 71·7              | 7·82        | 24    | 7·2    |
| Madras                                                                   | 96·3      | 7               | 71·6     | 20    | 90·3     | 76·2 | 75·7          | 84        | 147·1           | 70·8              | 8·21        | 15    | 5·5    |
| Kodaikanal                                                               | 66·0      | 27              | 50·8     | 11    | 62·2     | 52·9 | 53·1          | 89        | 143·6           | 46·1              | 9·73        | 20    | 8·3    |
| Colombo, Ceylon                                                          | 89·2      | 20              | 72·5     | 22    | 87·2     | 77·1 | 74·7          | 84        | 149·0           | 72·0              | 8·06        | 21    | 8·1    |
| Hongkong                                                                 | 87·7      | 19              | 73·0     | 6     | 82·9     | 75·8 | 73·1          | 84        | 134·8           | ...               | 16·54       | 15    | 6·2    |
| Melbourne                                                                | 80·2      | 11              | 34·4     | 15    | 62·7     | 47·5 | 43·3          | 70        | 141·7           | 28·2              | 3·18        | 11    | 6·6    |
| Adelaide                                                                 | 81·2      | 11              | 40·1     | 30    | 66·2     | 48·5 | 45·2          | 65        | 135·3           | 33·7              | 2·85        | 16    | 5·0    |
| Coolgardie                                                               | 87·8      | 26              | 37·9     | 7     | 68·9     | 45·7 | 44·4          | 62        | 149·4           | 33·9              | ·61         | 12    | 4·6    |
| Sydney                                                                   | 85·0      | 12              | 44·4     | 21    | 67·0     | 53·0 | 47·9          | 69        | 117·0           | 38·0              | 4·33        | 15    | 5·0    |
| Wellington                                                               | 63·5      | 12              | 33·0     | 6     | 56·1     | 42·8 | 39·9          | 64        | 111·0           | 22·0              | 4·36        | 17    | 6·5    |
| Auckland                                                                 | 64·5      | 21              | 42·0     | 6     | 59·6     | 49·2 | 45·1          | 71        | 134·0           | 39·0              | 2·40        | 16    | 5·2    |
| Jamaica, Negril Point.                                                   | 91·0      | 27              | 70·2     | 12    | 87·5     | 73·6 | 73·9          | 80        | ...             | ...               | 6·26        | 9     | ...    |
| Trinidad                                                                 | ...       | ...             | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...         | ...   | ...    |
| Grenada                                                                  | 90·0      | 21              | 72·0     | 2     | 85·4     | 75·1 | 71·6          | 75        | 154·0           | ...               | 9·51        | 19    | 2·9    |
| Toronto                                                                  | 83·8      | 13              | 33·8     | 29    | 71·3     | 50·6 | 54·5          | 78        | ...             | ...               | ·41         | 7     | 4·3    |
| Fredericton                                                              | 81·2      | 17              | 32·0     | 30    | 69·1     | 46·5 | 46·2          | 60        | ...             | ...               | 2·34        | 9     | 4·0    |
| Winnipeg                                                                 | 77·6      | 18              | 24·0     | 15    | 60·9     | 38·3 | ...           | ...       | ...             | ...               | 2·77        | 8     | 5·6    |
| Victoria, B.C.                                                           | 70·7      | 4               | 42·4     | 30    | 61·5     | 49·6 | ...           | ...       | ...             | ...               | 3·76        | 14    | 6·3    |
| Dawson                                                                   | 65·0      | 3               | 19·5     | 30    | 51·6     | 33·3 | ...           | ...       | ...             | ...               | 2·41        | 6     | 4·0    |

a and 22, 30.

**MALTA.**—Mean temp. of air 0°·6 below, dew point 1°·5, and E·11 in. below averages. Mean hourly velocity of wind 4·0 miles above average. Mean temp. of sea 77°·8. L on 7 days.

**Mauritius.**—Mean temp. of air 1°·0, and dew point 1°·6 below, and E·27 in. above, averages. Mean hourly velocity of wind 12·3 miles, or 0·8 above average; extremes, 30·5 on 20th and 2·1 on 7th; prevailing direction E.S.E.

**MADRAS.**—Rainfall 50 per cent. above average. Bright sunshine 131·5 hours.

**KODAIKANAL.**—Mean temp. of air 56°·2. Mean velocity of wind 314 miles per day. Bright sunshine 78 hours.

**COLOMBO, CEYLON.**—Mean temp. of air 81°·0 or 0°·2 above, of dew point 1°·4 above, and E 3·02 in. above, averages. Mean hourly velocity of wind 9·6 miles, prevailing direction S.W. TSS on 5 days.

**HONGKONG.**—Mean temp. of air 78°·6, or 1°·8 below, and E 3·90 above, averages. Bright sunshine 165·7 hours, or 34 below average. Mean hourly velocity of wind 13 miles; prevailing direction E.

**Adelaide.**—Mean temp. of air 0°·3 above, and E 1·11 in. above, averages.

**Sydney.**—Mean temp. of air 1°·1 above, humidity 1·4 below, and E 1·32 in. above, averages.

**Auckland.**—Mean temp. of air close to the average, and E quite one inch under the average.

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## THE RAINFALL OF THE WINTER MONTHS.

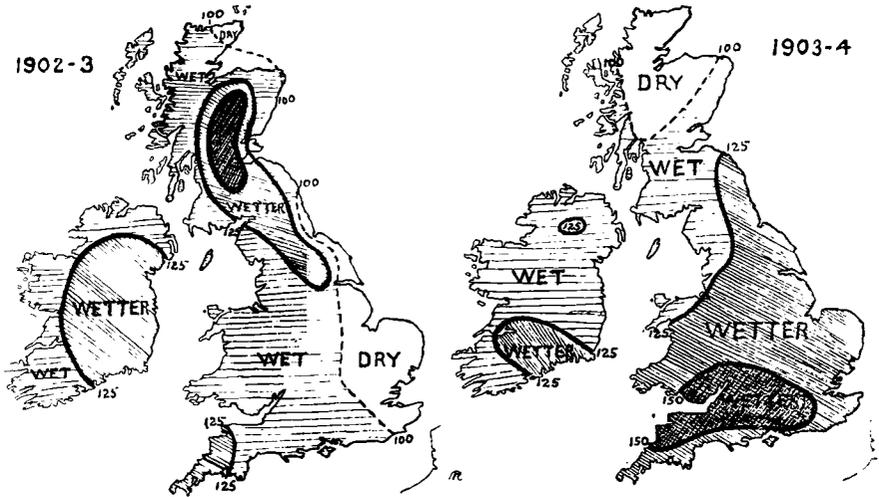
THE month of March concludes the winter half-year, and, before considering that period as a whole, it is desirable to look at the distribution of rainfall for the month. Over the greater part of England the rainfall of March was close to, or rather under, the average of the last ten years, that is to say considerably under the long-period average. In the east of England there was a slight excess of rainfall, the relatively wettest station reported in our tables being Brundall near Norwich, where, however, the excess amounted only to 20 per cent. The deficiency of rainfall was most marked in North Wales, where at Llandudno it amounted to 32 per cent. of the ten years' average.

In Scotland the rain was generally far below the average for the month, especially in the district bordering the Moray Firth, where the total fall of rain was less than one inch, and the deficiency at Cawdor near Nairn amounted to 72 per cent. ; in other words, the rainfall was little more than one quarter the usual amount. Ireland, however, showed a considerable excess of rainfall, except in the extreme north where it was dry. The wettest station was Waterford, where the excess amounted to 43 per cent. of the average fall.

The month, in fact, was a very ordinary March so far as rainfall is concerned ; rather wet in Ireland, rather dry in Scotland, and as nearly as possible normal in England.

In the ordinary treatment of rainfall statistics the figures are grouped according to the calendar years, but for many purposes it is more natural and more useful to divide the circle of the year into two parts as near the equinoxes as possible. The six months from October to March include the whole Winter, the late Autumn, and the early Spring, and the rainfall at a series of 51 stations for that period is summarised in the following Table. The first column gives the number of inches of rain above (+) or below (—) the ten years' average of the six months, and the second column shows the ratio which the rainfall of the six months bears to that average expressed as 100. It is interesting to compare the figures for the previous winter half-year as given in the number of this Magazine for April, 1903, p. 41. For the sake of clearness, the comparison has been

thrown into a graphic form in the two little maps here reproduced. The unshaded portion indicates the districts in which the six months, including winter, were drier than the average, the increasingly dark shading distinguishes those districts within which the rainfall



exceeded the average by less than 25 per cent., between 25 and 50 per cent., and by more than 50 per cent.; these may be called the wet, wetter and wettest areas. The chief interest in both cases attaches to Great Britain, the rainfall of Ireland having been similar each time, and showing an excess of from 20 to 26 per cent. During 1902-1903 it will be noticed that the wettest area lay in the centre of Scotland, and the dry area was confined to Caithness and the east of England. This was due entirely to the extraordinarily high rainfall of the first three months of 1903 in Scotland, when it was comparatively dry in England. During 1903-1904, on the other hand, the dry area was confined to northern Scotland, including almost the whole of the Highlands, while the greater part of England had a rainfall more than 25 per cent. in excess of the average, rising in the south in the Thames valley and the land bordering the Bristol Channel to an excess of more than 50 per cent. This was mainly due to the extraordinarily heavy rainfall of October, 1903, in that region.

For the British Isles, as a whole, the two periods of six months had approximately the same total rainfall, 1902-3 having an excess seven per cent. less than 1903-4; but in the latter period England was 30 per cent. wetter than in the former, while both Scotland and Ireland were drier. The exact ratios to the average of 100 are:—

|                         | 1902-3. | 1903-4. | Diff. |
|-------------------------|---------|---------|-------|
| England and Wales ..... | 107     | 137     | + 30  |
| Scotland .....          | 127     | 107     | - 20  |
| Ireland.....            | 126     | 120     | - 6   |
| British Isles .....     | 117     | 123     | + 6   |

The curious interchange of position in the wettest and the dry area may be summed up by saying that in the winter half-year, 1902-3, the country grew wetter from south-east to north-west, while in the winter half-year, 1903-4, it grew wetter from north to south, the wetness and dryness being considered relatively to the ten-years' average at each point.

*Six Months' Winter Rainfall: October, 1903—March, 1904.*

| Stations.        | Diff. from Aver. | Per cent. of Aver. | Stations.        | Diff. from Aver. | Per cent. of Aver. | Stations.      | Diff. from Aver. | Per cent. of Aver. |
|------------------|------------------|--------------------|------------------|------------------|--------------------|----------------|------------------|--------------------|
|                  | in.              |                    |                  | in.              |                    |                | in.              |                    |
| London .....     | + 4.43           | 139                | Arncliffe ...    | + 5.04           | 114                | Braemar ...    | - 1.61           | 91                 |
| Tenterden .....  | + 3.79           | 129                | Hull .....       | + 1.15           | 109                | Aberdeen ...   | + 3.42           | 120                |
| Hartly Wntn y+   | + 7.27           | 157                | Newcastle...+    | + 6.13           | 148                | Cawdor .....   | - 2.02           | 86                 |
| Hitchin .....    | + 4.61           | 140                | Seathwaite +     | + 4.73           | 106                | Glencarron --  | + 6.74           | 88                 |
| Winslow .....    | + 4.68           | 139                | Cardiff .....    | + 11.30          | 153                | Dunrobin ...-  | - .19            | 99                 |
| Westley .....    | + 2.66           | 122                | Haverf'dwest+    | + 7.11           | 128                | Darrynane +    | + 5.17           | 119                |
| Brundall .....   | + 2.01           | 117                | Gogerddan +      | + 7.52           | 130                | Waterford +    | + 9.26           | 146                |
| Alderbury .....  | + 8.81           | 158                | Llandudno +      | + 3.16           | 119                | Broadford...+  | + 7.59           | 144                |
| Ashburton .....  | + 13.91          | 145                | Dunfries ...+    | + 3.17           | 113                | Carlow .....   | + 2.01           | 111                |
| Polapit Tamar +  | + 14.95          | 174                | Lilliesleaf ...+ | + 4.40           | 128                | Dublin .....   | - .42            | 103                |
| Stroud .....     | + 6.57           | 149                | Colmonell ...+   | + 4.71           | 119                | Mullingar ...+ | + 3.86           | 121                |
| Woolstaston ...+ | + 5.88           | 139                | Glasgow ...+     | + 1.49           | 108                | Ballinasloe +  | + 3.53           | 119                |
| Boston .....     | + 3.83           | 140                | Inveraray ...+   | + .17            | 100                | Clifden .....  | + 4.60           | 111                |
| Hesley Hall ...+ | + 2.87           | 127                | Islay .....      | + 5.09           | 119                | Crossmolina +  | + 5.32           | 117                |
| Derby .....      | + 4.19           | 139                | Mull .....       | + 6.54           | 120                | Seaforde ...+  | + 4.44           | 123                |
| Bolton .....     | + 6.37           | 132                | Loch Leven +     | + .68            | 103                | Londonderry+   | + 2.49           | 112                |
| Wetherby .....   | + 8.10           | 171                | Dundee .....     | + 1.48           | 110                | Omagh .....    | + 7.34           | 136                |

**SOME WEATHER PROPHETS.**

By WILLIAM ELLIS, F.R.S.

WE are sometimes told that in improving elementary education and teaching the masses to read, the more difficult task of at the same time instilling a desire to read intelligently, has not in equal degree been imparted, a scrappy and sensational class of literature having arisen adapted to the existing order of mind, thus misdirecting an ability that might be better employed. But like all good things, education has also its weak side. In matters scientific the increased opportunities for study in our day are again good, but in this direction also there is misdirected energy. Not that a lesser degree of scientific knowledge is useless, rather is it beneficial when used with discretion, but unfortunately the present facilities for publication are such as to tempt those only partially acquainted with a subject to presume to teach. Their incomplete knowledge instead of suggesting further study and inquiry, seems rather to impel them to publish crude and ill-considered theories that reveal only the incapacity of the

author, who in some blind manner convinces himself that he has all at once discovered that which previous patient workers have failed to find. Ignorance is shown of the conditions of a problem as well as of the proper manner of treating it. There have been those who to their own satisfaction have shown Newton to be wrong, or the Earth to be flat, in spite of overwhelming evidence to the contrary. In our day, however, a favourite pursuit seems to be prediction of the weather and other natural phenomena for long periods in advance. In this field we have many prophets, who seem to consider inductive methods to be to a great extent superfluous, preferring rather to form arbitrary theories of weather change to which Nature is expected to submit; at least, each separate prophet appears to make out that his own particular predictions are verified.

These remarks have been suggested by the variety of publications that we receive treating of weather change and prediction of the weather on a supposed scientific basis that is really grounded in error. We have on our table "The British Astronomical Weather Almanac and Chart, 1904, by B. G. Jenkins, F.R.A.S.," which is said to be "for landed proprietors, farmers, gardeners, sailors, fishermen, and the public generally." This is a large claim to make. Let us examine it a little. The main feature of the almanac is "The British Weather Chart." Investigating the question of weather change, Mr. Jenkins says that although the moon has a great deal to do therewith, her influence alone is not sufficient to account for all the observed weather phenomena, and that the sought-for perturbation is to be found in the combined influence of the sun, moon and planets. The whole matter, however, is said to be fully explained in a separate publication, "'Tellustria'; a method for determining astronomically the variations in the temperature and pressure of the atmosphere." What is called the "telluric curve," showing the disturbance produced in our atmosphere, is given for the whole year, also the corresponding thermometric and barometric curves, with predictions of the probable weather in each month of the year. The explanation given in the almanac is not, however, complete. All this apparently would be satisfactory, but that "there are discrepancies which the telluric curve does not explain, even when it is calculated from estimates of the masses and distances of the planets used by English, French, German, and American astronomers, which are not identical; but it is reasonable to suppose that these will disappear when astronomers have secured more accurate data." It is sad to think that errors in that supposed most exact of all sciences, astronomy, should so hinder the perfecting of a weather theory; but does Mr. Jenkins understand how comparatively insignificant are these so-called discrepancies? Surely, data good enough to foretell eclipses of the sun and moon for very many years to come to within a few seconds of time should be sufficient for his purposes. It is indeed mere trifling; there is no sense of proportion in such a contention. What is proposed cannot be done. Besides, the monthly

forecasts, even if they were in any degree accurate, are altogether so vague. Unfortunately the employment of a scientific phraseology gives an appearance of authority to predictions of the kind that they in no way possess, and the press, which should be able to guide the public mind in the matter, gives not unfrequently only laudatory notices to such works. Mr. Jenkins quotes two on the title-page of his almanac, both from journals of good standing. One of these states that he is "a scientific meteorologist who merits our serious attention," the other says that persons of undoubted veracity declare that it is "wonderfully accurate." But to predict the character of the weather month by month for a year in advance is at present wholly impossible. No editor of any journal of note would be content to show ignorance in matters of art, why then should any editor be satisfied with so low a standard of criticism in a matter involving a little knowledge of science?

To consider now another case. In a volume reviewed in these pages in February, 1903 (Vol. 38, p. 9), Mr. William Digby, C.I.E., enthusiastically puts forward the theories of Mr. Hugh Clements, of whom we have often heard before. Mr. Clements himself also publishes from time to time pamphlets concerning his far-reaching theories. Here again, as with Mr. Jenkins, the moon is a great agent in producing weather changes, for as the influence of the sun is "exactly the same on any given date of any given month year after year" it may be neglected, "and the moon's motions alone considered in the estimation of weather changes." To predict the weather correctly for any given place it is necessary to know "the actual height of the barometer." This is determined by the consideration that as at the beginning and end of some one of certain lunar cycles (any one of several it seems might be employed) the position of the moon will be nearly similar, the height of the barometer should be also nearly similar, and the reading recorded on the day in the past being corrected for the difference between the two positions of the moon, according to a supposed satisfactorily determined relation, the reading on the day in the future is found. Wonderful, is it not? Unfortunately, however, it has no foundation whatever in fact. Whether Mr. Clements formed his "Weather Predictions for the Autumn, 1904," in this way from heights of the barometer determined as described seems not clear; he, however, gives the dates of unsettled weather for the four months of September to December at some twenty places as widely separated over the globe as London, New York and Tokio. According to this the meteorological condition is to be similar at Christiania, Stockholm and St. Petersburg, and, what is equally remarkable, similar also at Paris and Vienna. By means of the lunar-cycle theory of barometric variation there is to be found in Appendix I. of Mr. Digby's book some wonderful work concerning the height of the barometer on days round that first fixed for the coronation of the King, June 26, 1902, prepared in the previous spring, the energy displayed in which

is, we fear, simply a measure of the uselessness of the result. And as though the absurdities in regard to weather prediction were not enough, Mr. Clements applies his amazing theories to other natural phenomena, claiming to predict earthquakes and volcanic eruptions, both small and great, as accurately as eclipses of the sun and moon. Neither are droughts and famines at all out of his way. It is settled that sun-spots are produced by planetary attraction, and magnetic storms are easily foretold. But these disquisitions on subjects into which we cannot here enter are equally as absurd as are those regarding weather change. The question having been asked in some journal, "When will a Kepler and a Newton arise to evolve order out of chaos in meteorology?" it is contended that in Mr. Clements the man has been found. Indeed, it is seriously suggested that the time is passed when "a proved theory of vast public value, a theory which put into practice . . . . would make British agriculture less of a chance, and more of a business than it now is, or in existing conditions can ever possibly become, shall be allowed to languish for lack of proper recognition and adequate support," since it is not possible to conceive greater advantages to be derived "from any discovery in recent centuries, or perhaps at any time in the world's history." But yet after working for some twenty years, Mr. Clements finds public bodies to be still indifferent.

Another writer, who expresses himself in agreement with the views of Mr. Clements, sends from Zomba, in British Central Africa, forecasts of rainfall for a year in advance at four separate districts in that region. He endeavours to connect rainfall with lunar action, and writes:—"The above and below years of rain appeared to coincide with more than accidental similarity to the declination of the moon in a 19 years' cycle, and so similar as to suggest that the moon was possibly the cause." The author would appear to be scarcely competent to conduct such inquiries, the knowledge of astronomy disclosed in his communication being of a crude order. He, however, keeps what appears to be a very creditable meteorological register, observations of the usual character being made three times on each day; and this is a solid contribution to scientific knowledge.

Referring to our opening remarks, may we not ask how it happens that men, otherwise of considerable intelligence, can persevere in a task at present so utterly hopeless as the endeavour to predict detailed weather changes for long periods in advance, thus deceiving themselves (if only they knew it) and also those who put any sort of trust therein? When such predictions appear to be in some degree correct, it is entirely a matter of accident, since by no known method, by reference to no celestial body whatever, can the character of the weather, for any length of time in advance, be foretold. One or two such forecasts accidentally fulfilled seem to convince some people that a true weather prophet has at last appeared. They forget all the failures. Even mere guessing will not unfrequently be, to an extent, right. Do people ever realize that if the weather were set

down by hazard, in advance, on alternate days throughout some year, as simply "wet" or "dry," how often the "prediction" would be correct? and yet it would all signify *nothing* as regards prevision of the weather.

One idea that so misleads many weather prophets, and also others, is that as the moon is the principal agent in producing ocean tides, so also must she be the main cause of weather change. Such an impression is held more or less strongly by a not inconsiderable number of persons of general intelligence, not exactly perhaps of a scientific turn of mind. Some cannot see, and others have never remarked, what so repeatedly has been pointed out, that tides are a matter of attraction, whilst weather changes are an effect of heat, the action of solar heat on our atmosphere combined with the revolution of the Earth on its axis, by which means are produced all those variations of temperature (daily and yearly), of atmospheric pressure, cloud, wind, and, by evaporation and precipitation also, rainfall, which go to make up what we experience as weather. No sensible heat whatever is received from the moon, and it is doubtful whether any even small degree of lunar influence on weather has ever been definitely traced.

The able criticism which Professor Klossovski, of Odessa, has brought to bear on the lunar weather forecasts of his countryman, Mr. Demchinsky, whose wealth and social influence have enabled him to give a more elaborate expression to his views than his fellow-prophets in other lands could attempt, has already been summarised in this Magazine for March, Vol. 39, p. 31, and the arguments seem absolutely conclusive.

Our own Meteorological Office, receiving daily telegrams of the condition of the weather from numbers of stations covering a wide extent of country including the Continent, can do no more than predict weather for one or two days in advance. We suffer in some degree from the circumstance that our country borders on the Atlantic, from which direction weather changes will so suddenly come, and nothing better in the way of forecasts can be at present done. The use of the Meteorological Office consists as much in the valuable meteorological statistics that are collected, and from time to time published, as in the forming of weather forecasts for the coming day.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

### GRADUATION OF RAIN GLASSES.

IN the Magazine received this morning I see a letter *re* "Graduation of Rain Glasses." As an observer since 1855, now nearly half a century, I quite agree with the writer that glasses might be more clearly graduated, and that it should be done on both sides. Mine

have always been so, and are clear enough to me now, though I cannot see as well as I used to do. I think they might well be graduated to '60 in. I have always glued a bit of paper to mine with the graduations above '50 in. marked on it, but it was seldom required.

MICHAEL FOSTER WARD.

*Upton Park, Slough, 17th March, 1904.*

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YOU ask for the opinion of your readers on the point raised in the last number of the Meteorological Magazine: "the Graduation of Rain Glasses." I see no reason for alteration; rather the reverse. The usual scale engraved on the measuring glasses as supplied, for instance, by Casella fulfils every necessary requirement; with such an instrument I have registered the rainfall for even a longer period than your correspondent. Provided the glass be kept clean, the scale is definite enough; quickness in reading any scale, especially one so simple as usually marked on rain glasses, is to be deprecated.

W. L. W. EYRE.

*Swarraton Rectory, Alresford, Hants, March 18th, 1904.*

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I FOR one quite endorse your correspondent's remarks as to the advisability of more definitely marking the rain measuring glasses, and such a method as he suggests would no doubt lend itself to the accurate reading of them. I do not, however, think it would be at all advisable to alter the length from '50 in. to '60 in., for then the reading would be much more liable to error when one is dealing with over an inch of rain, which one has frequently to do in this locality, and I also think that we should find the '60 in. would just as often be exceeded as '50 in.; so where would be the gain?

I have just looked through my records for the past four years and find that during that period I have between '50 and '60 22 times, and between '60 and '70 22 times, exactly the same number.

CHAS. P. CHAMBERS.

*Orchard Head, Broughton-in-Furness, April 2nd, 1904.*

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ABOUT the marking of the measuring glasses of rain gauges: I have been a daily observer and registrar since 1872, and I have never experienced the difficulty which your correspondent mentions. From that time I have used Casella's rain gauge and his glass for measuring, and though my sight may not be as good as the majority of observers possess, I have never had the slightest difficulty. I can always register the exactest decimal point required, and though for uniformity's sake I strictly keep to it, I am often tempted to read more closely still—so easy is it to be even more accurate.

T. W. SIDEBOTHAM.

*The Bourne Vicarage, Farnham, 2nd April, 1904.*

## ATMOSPHERIC PRESSURE IN RELATION TO CLIMATE.

IN reply to the letter of Mr. Dines which appeared in the March number, I must say that by "anticyclonic conditions over the British Isles," I do not mean the prevalence (a meaning which, as Mr. Dines says, would be quite incorrect) of a system of high pressure over Scandinavia; in other words, the easterly type of weather, which, as is well known, is often responsible for extremely low temperatures in the south of England.

Of course it is a matter of common observation that many of the anticyclones which temporarily control the weather over the United Kingdom during the winter are not associated with any great reduction of temperature below the mean, and the facts which Mr. Dines adduces doubtless render his assertion, such as it stands, indisputable. But it must be a fact well known to everyone, that after a period of high temperature in winter the effect of the advance of an anticyclone over the United Kingdom is almost invariably to reduce the mean temperature to the normal or slightly below it, and there can be little doubt that if anticyclonic conditions, properly so called, were to set in during the autumn and to persist throughout the winter months, just as they do over the great continental land masses, the mean temperature would sink to somewhere near the normal for a country situated between the 50th and 60th parallels of north latitude—that is to say, it would be from  $10^{\circ}$  to  $20^{\circ}$  F. lower than it is—for under these conditions the gradient for *strong* south-westerly winds, to the prevalence of which undoubtedly the comparatively high winter temperature must be ascribed, would not exist.

An anticyclone to develop its effects must be persistent, and it is not indeed surprising that the high-pressure systems which we so often experience for a brief period are frequently not productive of great cold.

Finally, as a matter of interest I might add that a recent example of a severe though short frost, accompanying conditions which must be described as typically anticyclonic, occurred in Scotland during the winter of 1902. On the mornings of the 31st of January and 1st of February of that year the centre of an anticyclone of exceptional intensity was situated off the east coast of Scotland. (Meteorological Office Reports.) At 8 a.m., January 31st, the barometer at Aberdeen stood at the unusually high level of 31.05 inches, and the air temperature at the same time was  $15^{\circ}$  F.; on the following morning the barometer at Aberdeen stood at 31.04 inches, and the thermometer at  $19^{\circ}$  F., while at Nairn at the same time temperature was as low as  $10^{\circ}$  F. and pressure as high as 31.04 inches. This cold, which was doubtless still greater further inland, accompanying light airs or calms and clear skies, was evidently directly related to the anticyclone. By the middle of February the frost had entirely disappeared from Scotland, the area of greatest

cold having by that time shifted to the south of England and the adjacent parts of the continent ; on the morning of the 16th, temperature was as low as 18° F. both in London and in Paris, and the charts show that on that morning the south-east of England lay well within the influence of an anticyclone centred over the very cold region of northern Germany.

L. C. W. BONACINA.

*22nd March, 1904.*

### THE STORMS OF MARCH 29th-30th, 1904.

A FEW notes may be of interest on the storms of the above dates as experienced in this district. On the 29th, towards 2.30 p.m., after a fairly fine forenoon, cumulo nimbus (thunder clouds), preceded by cirro-velum, gathered up. A sharp thunderstorm broke towards 2.45 p.m., and though of short duration, was very heavy while it lasted, fork and sheet lightning were especially vivid, hail of an exceptional size falling in the rear of the storm. In the evening, at 7.30 p.m., a remarkable sky of a most brilliant green hue was visible to the westward. On the 30th heavy snowstorms prevailed to noon, the snow flakes being remarkable for their size. Thunder clouds again gathered up towards 3 p.m., a storm passing over about 3.15 p.m., with almost continuous flashes of sheet and fork lightning, hail again falling, and in exposed situations the rattling of the stones on glass was very loud. Inky darkness prevailed for a short time on both occasions. A noticeable feature of both storms was the remarkable lowness of the clouds at the time.

S. C. RUSSELL.

*Sutton, Surrey, April 4th, 1904.*

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### SCOTTISH METEOROLOGICAL SOCIETY.

THE half-yearly General Meeting of this Society was held in the Philosophical Institution, Edinburgh, on March 24th, the Hon. John Abercromby presiding over a large attendance.

The report of the Council was adopted, Lord M'Laren being appointed President of the Society in place of the late Duke of Richmond and Gordon, and Sir Arthur Mitchell, K.C.B., succeeding Lord M'Laren as Vice-President. Three Members of Council retired by rotation, the vacancies being filled by the election of Professor J. G. MacGregor, and the re-election of Sir John Murray, K.C.B., and Mr. J. Y. Buchanan.

It was intimated that the Council had some time ago received a request from the German Marine Observatory (Deutsche Seewarte) for daily weather telegrams from the Ben Nevis and Fort William Observatories, to be used in connection with the daily forecasts issued from Hamburg. Arrangements were now completed, and a letter had just been received requesting that the transmission of these telegrams should commence in April. The meteorological

bureau of a foreign country would thus be the first to utilize the Ben Nevis observations in its daily weather report.

It was further intimated that it would not be possible to finance the Ben Nevis Observatories after the beginning of October of this year unless a sum of at least £600 per annum were guaranteed, in addition to the continuance of the sums of £100 and £250 which had up to that time been given by the Meteorological Council out of the Parliamentary grant.

Dr. Buchan read a paper on "The Ben Nevis Observatories in relation to Forecasting," in which he discussed some of the points dealt with in the last Report of the Ben Nevis Committee to the British Association (see this Magazine for February, Vol. 39, p. 11), and showed what had been done in working out some of the lines of research indicated in that report. Diagrams were exhibited showing by monthly averages for each hour of the day the difference between the Ben Nevis and Fort William barometric readings when both were reduced to sea level by the usual tables. Including all observations, except those where strong winds rendered the barometric readings unsatisfactory through pumping of the mercury, the curves showed that for the greater part of the year the reduced Ben Nevis barometer came out higher than the Fort William barometer during the night and lower during the day. If, however, only those days were considered for which the mean difference of temperature between the top and bottom of the mountain exceeded  $18^{\circ}$  F., the curves showed that the reduced Ben Nevis barometer was below that for Fort William throughout, though not so much below at night as during the day. On the other hand, on days when the mean difference was small, less than  $12^{\circ}$  F., the reduced Ben Nevis barometer was higher than that at Fort William. The curves for the days when the temperature difference was between  $12^{\circ}$  F. and  $18^{\circ}$  F. lay between the curves for the extreme cases.

Lord McLaren congratulated Dr. Buchan on his paper, and remarked upon the action of the Meteorological Office with respect to Ben Nevis.

Mr. A. Watt followed with a paper on "Sunshine at Home and Abroad" He was indebted for his material to the mean values published by the Meteorological Council, to H. König's exhaustive treatise, and to original MSS. In Scotland, and indeed in North-western Europe generally, May was the sunniest month, and it was to be noted that May was also the month of highest atmospheric pressure in that region. The May maximum was peculiarly well marked in the Orkneys—Deerness averaging about an hour more sunshine per day in May than in June (May 180 hrs., June 151 hrs.) In the South of Europe July and August were the sunniest months, and in the South of England there was an inclination to this later maximum. Comparing the climate of Davos with that of the South of England, it was found that in the course of the year Davos and such favoured places as Hastings and Torquay received about the

same amount of sunshine. The seasonal distribution, however, differed greatly. In summer the English stations were much sunnier, but from October to March Davos had 30 per cent. more sunshine, and from November to February it averaged fully an hour more sunshine per day than any place in England.

The Swiss sunshine records were of exceptional interest, as returns were available for very different heights. Thus ten years' observations for Zürich (1617 ft.), Davos (5108 ft.) and Säntis (8202 ft.) gave the following mean values, in hours:—

|            | Jan. | Feb. | Mar. | Apr. | May. | June | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Year. |
|------------|------|------|------|------|------|------|-------|------|-------|------|------|------|-------|
| Zürich...  | 42   | 94   | 137  | 171  | 185  | 223  | 241   | 243  | 179   | 111  | 51   | 43   | 1720  |
| Davos ...  | 92   | 109  | 153  | 161  | 168  | 176  | 208   | 214  | 176   | 143  | 109  | 87   | 1796  |
| Säntis ... | 113  | 126  | 138  | 148  | 145  | 148  | 174   | 193  | 161   | 151  | 141  | 114  | 1752  |

Except in March, the amount for Davos was intermediate between those for Zürich and Säntis, whilst from October to February Säntis recorded the most, and from April to September the least of the three stations.

### ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, March 16th, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

The following gentlemen were elected Fellows:—Mr. Peter Anderson, Mr. Eugene André, F.R.G.S., Mr. William Henry Dobson, Mr. Thomas Price Thomas, and Mr. Hanns Vischer, M.A., F.R.G.S.

This being the "popular" meeting of the session, Mr. Richard H. Curtis, at the request of the Council, gave a lecture on "Water Vapour," which he illustrated by experiments and lantern slides.

After explaining the nature of water-vapour, the lecturer proceeded to speak of the processes of evaporation and condensation, and showed that the capacity of the air for moisture varies according to the temperature. He pointed out that the quantity of vapour present in the atmosphere varies very much in different regions of the globe, and in most places it varies also a great deal at different times and occasionally within very brief periods. It is a most important factor in Climate. There are parts of the globe where vapour is always present in great abundance, and in consequence the air is constantly damp and humid, and in a nearly saturated condition. The calm region near the Equator which marks the meeting place of the North-east and South-east Trade winds is an example of such a humid climate. On the other hand, there are regions where the quantity of vapour is always small, both relatively and absolutely. Inland regions far removed from any considerable source of supply, and subject to strong sun-heat, are generally in

this condition; and the central portions of Australia, parts of Arabia, and the desert regions of Africa, are examples of such parched and arid climates.

The amount of vapour in the air has a great deal to do with our personal comfort. A dry cold air is not so unpleasant and does not feel so cold as a damp air, although the temperature of the damp air as shown by the thermometer may be the higher. But our sensations are often at variance with the thermometer, and this is generally so because of the way in which they are affected by the vapour in the air. If the air be dry a degree of heat also can be enjoyed which would be simply unendurable if it occurred with a humid atmosphere.

Mr. Curtis referred to some phenomena of the atmosphere in which water-vapour plays a leading part, and described the formation of dew, hoar-frost, fog, cloud, halos, rain, snow and hail. He concluded by saying that he had tried to show how a particle of water may be taken from the ocean and stored away invisible in the atmosphere above it; how that particle may travel to distant parts of the globe, and then by the action of another of Nature's processes be changed back again into water, and fall once more upon the ground beneath; here it may unite itself to other similar drops, and together form a tiny stream, which may gradually grow to the dimensions of a river; and once again our drop of water may find itself a constituent part of the ocean, to repeat its pilgrimage and carry on the part it is destined to play in the economy of Nature.

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## METEOROLOGICAL NEWS AND NOTES.

THE BRITISH ANTARCTIC EXPEDITION returned to Lyttelton, New Zealand, on April 1st, with all well on board. Captain Scott has thus the unique distinction of having spent two consecutive winters in the Antarctic regions at a higher latitude than any other expedition has ever penetrated, and without the loss of a man from disease. The meteorological observations cannot fail to have been of the greatest interest; and, although no particulars of the scientific results have yet been received, Captain Scott states that the work of the second year was more important than that of the first. The expedition throughout has been a brilliant success, surpassing all expectation.

IN NEW ZEALAND Meteorological matters are provided for in two Government Departments:—The Climatological, or Statistical, in one (from the control of which Sir James Hector has recently retired); and the Weather, or Forecasting Branch, in another, under the charge of Captain Edwin, R.N., of the Marine Department.

THE HEALTH RESORTS OF NEW ZEALAND are the subject of a forthcoming work by Dr. Wohlmann, the Government Balneologist at Rotorua, the most famous sanatorium of New Zealand. It will

deal with the climate of that favoured colony, the natural beauty of the scenery of which is probably unrivalled in the southern hemisphere.

A CENTRAL WEATHER BUREAU FOR AUSTRALIA is, we understand, likely to become an accomplished fact. There is no department in which the federal government of the Commonwealth can incorporate or correlate the separate State organizations with more probability of increasing efficiency without sacrificing economy than in the treatment of Meteorology. We hope that the new meteorological system will be extended to all Australasia, including New Guinea, New Zealand and Fiji.

THE METEOROLOGICAL DEPARTMENT OF THE TRANSVAAL has, we understand, decided to present to a certain number of its observers a year's issue of this Magazine, with the object of encouraging the study of Meteorology and bringing the isolated observers in different parts of the empire into touch with one another. We are gratified in obtaining an accession to the number of our readers in a country so full of interest as the Transvaal, and hope that the exchange of experiences with fellow-observers at home will be of profit to both.

THE PHOTOGRAPH OF THE METEOROLOGICAL BREAKFAST at Southport, which was issued with the number of this Magazine for December, 1903, and intended to serve as a frontispiece to Vol. 38, seems to have been omitted from some copies. Any reader who has received the December number without the plate is requested to return it to the Editor at 62, Camden Square, London, N.W., and a perfect copy will be sent in exchange.

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SIR JOHN ELIOT ON THE METEOROLOGY OF THE EMPIRE.

THE new magazine, *Broad Views*, for March contains an instructive article by Sir John Eliot on "The Meteorology of the Empire," for the unique period 1892—1902, during which time India, Australia, and South Africa, especially suffered more severely from droughts than during any other similar period for a hundred years at least. It is estimated that in New South Wales alone some fifty million sheep perished during the almost continued drought of 1895—1902. The author deals more particularly with the meteorology of India, the primary feature of which is, as is well known, the nearly equal division of the year into wet and dry seasons. The dry period culminates about the end of May, over Northern and Central India, when day temperatures of 115° to 120° are registered. The weather conditions are completely reversed with the advent of the wet season, and in the course of a few days all nature becomes instinct with life and growth. Excessive rains, such as occurred in 1892-4, rarely affect large areas to such an extent as to destroy crops, but deficient rainfall, which occurred between 1895 and

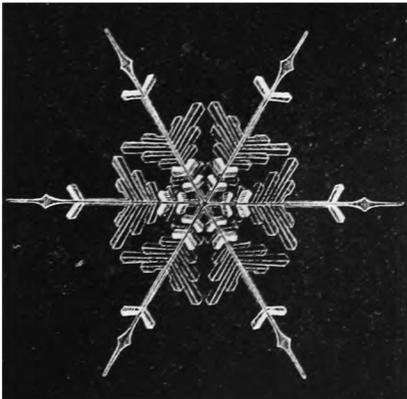
1902, with the exception of 1898, especially when the falls terminate early, is very serious, and may prevent the maturing of the crops. We are unable to enter fully here into this very interesting article, but may mention the author's opinion that the next development of weather study will almost certainly be in the relation of meteorology to the phenomena of sun spots and terrestrial magnetism. He also approves of what he considers a most valuable suggestion, made by Sir Norman Lockyer, that the meteorological data from the whole Empire should be collected and dealt with by a special branch of the British Meteorological Office.

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### REVIEW.

*Studies among the Snow Crystals during the winter of 1901-1902, by MR. WILSON A. BENTLEY. Reprinted from the Annual Summary of the U.S. Monthly Weather Review for 1902. Size  $11\frac{1}{2} \times 9\frac{1}{2}$ . Pp. 10. Plates.*

MR. W. A. BENTLEY has devoted twenty years to the study of the forms of snow-crystals, and this contribution consists of twenty-two plates, each containing twelve micro-photographs of snow-crystals magnified about twenty diameters. Before photography was enlisted to aid the artist, the pictures of snow-crystals were necessarily rather unsatisfactory. Seen in their entirety only for a moment, it was impossible to say that any slight irregularity was natural or merely the result of melting setting in at one point before another. In the delightful series of snow-crystals published by the late Mr. Glaisher in 1855, we understand that only one ray or segment of the crystal was actually drawn from nature, the other five being filled in by copying the first. How near the truth this method came may be judged by the accompanying comparison of one of Mr. Glaisher's symmetrical drawings with one of Mr. Bentley's actual photographs of a somewhat similar form.



DRAWING BY MR. GLAISHER.



PHOTOGRAPH BY MR. BENTLEY.

RAINFALL AND TEMPERATURE, MARCH, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.   |                             |                       |        |      | Days on which 1/10 or more fell. | TEMPERATURE. |       |                 |       | No. of Nights below 32°. |       |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------|-----------------------|--------|------|----------------------------------|--------------|-------|-----------------|-------|--------------------------|-------|
|        |                                                                                                                                      | Total Fall. | Diff. from average, 1890-9. | Greatest in 24 hours. |        | Max. |                                  | Min.         |       | Shade           | Grass |                          |       |
|        |                                                                                                                                      |             |                             | Depth                 | Date.  |      |                                  | Deg.         | Date. |                 |       | Deg.                     | Date. |
| I.     | London (Camden Square) ...                                                                                                           | 1.72        | + .26                       | .36                   | 30     | 15   | 61.0                             | 9            | 27.9  | 17              | 8     | 19                       |       |
| II.    | Tenterden.....                                                                                                                       | 1.47        | — .22                       | .32                   | 1      | 14   | 58.0                             | 8, 9         | 24.0  | 2               | 9     | 20                       |       |
| „      | Hartley Wintney .....                                                                                                                | 1.35        | — .21                       | .26                   | 28     | 16   | 57.0                             | 31           | 25.0  | 12              | 11    | 23                       |       |
| III.   | Hitchin .....                                                                                                                        | 1.32        | — .12                       | .24                   | 28     | 16   | 57.0                             | 9            | 26.0  | 1, 11           | 15    | ...                      |       |
| „      | Winslow (Addington) .....                                                                                                            | 1.45        | — .07                       | .25                   | 28     | 16   | 59.0                             | 9            | 25.0  | 12              | 15    | 26                       |       |
| IV.    | Bury St. Edmunds (Westley) .....                                                                                                     | 1.55        | — .08                       | .30                   | 29     | 16   | 63.0                             | 19           | 24.0  | 17              | 17    | ...                      |       |
| „      | Brundall .....                                                                                                                       | 1.93        | + .32                       | .50                   | 28     | 19   | 60.0                             | 19           | 24.2  | ...             | 9     | 18                       |       |
| V.     | Alderbury .....                                                                                                                      | 1.39        | — .29                       | .31                   | 4      | 12   | 52.0                             | 9            | 26.0  | 15              | 12    | ...                      |       |
| „      | Winterborne Steepleton .....                                                                                                         | 1.85        | ...                         | .53                   | 7      | 11   | 59.1                             | 9            | 25.3  | 16              | 11    | 17                       |       |
| „      | Torquay (Cary Green) .....                                                                                                           | 2.03        | ...                         | .62                   | 4      | 15   | 58.6                             | 9            | 32.5  | 1, 12           | 0     | 17                       |       |
| „      | Polapit Tamar [Launceston] .....                                                                                                     | 2.14        | — .14                       | .66                   | 7      | 12   | 57.1                             | 9            | 23.1  | 12              | 13    | 16                       |       |
| „      | Bath .....                                                                                                                           | 1.86        | ...                         | .55                   | 4      | 16   | 59.5                             | 9            | 25.5  | 12              | 1     | 2                        |       |
| VI.    | Stroud (Upfield).....                                                                                                                | 1.57        | — .11                       | .38                   | 28     | 16   | 57.0                             | 23           | 29.0  | 1, 2, 11        | 10    | ...                      |       |
| „      | Church Stretton (Woolstaston) .....                                                                                                  | 1.57        | — .20                       | .36                   | 7      | 21   | 57.0                             | 20           | 24.5  | 1               | 17    | ...                      |       |
| „      | Bromsgrove (Stoke Reformatory) .....                                                                                                 | 1.03        | — .22                       | .22                   | 7      | 15   | 54.0                             | 20           | 23.0  | 1               | 19    | ...                      |       |
| VII.   | Boston .....                                                                                                                         | 1.21        | + .02                       | .20                   | 8, 14  | 12   | 58.0                             | 20           | 26.0  | 18              | 15    | ...                      |       |
| „      | Bawtry (Hesley Hall) .....                                                                                                           | 1.64        | + .24                       | .44                   | 7      | 18   | 60.0                             | 20           | 23.0  | 12              | ...   | ...                      |       |
| „      | Derby (Midland Railway)... ..                                                                                                        | 1.57        | + .15                       | .40                   | 7      | 20   | 58.0                             | 20           | 24.0  | 11              | 14    | ...                      |       |
| VIII.  | Bolton (The Park) .....                                                                                                              | 2.34        | — .38                       | .29                   | 13     | 18   | 54.2                             | 20           | 26.9  | 1               | 9     | 22                       |       |
| IX.    | Wetherby (Ribston Hall) ...                                                                                                          | 1.94        | + .31                       | .57                   | 7      | 19   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| „      | Arncliffe Vicarage .....                                                                                                             | 4.65        | — .47                       | 1.59                  | 28     | 23   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| „      | Hull (Pearson Park) .....                                                                                                            | 1.85        | + .19                       | .39                   | 14     | 19   | 59.0                             | 20           | 26.0  | 18              | 8     | 21                       |       |
| X.     | Newcastle (Town Moor) .....                                                                                                          | 1.38        | — .56                       | .20                   | 7      | 18   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| „      | Borrowdale (Seathwaite) ...                                                                                                          | 12.51       | + 1.85                      | 3.73                  | 20     | 17   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 2.73        | + .17                       | .73                   | 7      | 18   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| „      | Haverfordwest (High St.)... ..                                                                                                       | 2.29        | — .45                       | .55                   | 7      | 15   | 52.6                             | 23           | 26.5  | 12              | 8     | 15                       |       |
| „      | Aberystwith (Gogerddan).. ..                                                                                                         | 2.12        | — .72                       | .28                   | 18     | 14   | 60.0                             | 9            | 22.0  | 10 <sup>a</sup> | 14    | ...                      |       |
| „      | Llandudno .....                                                                                                                      | 1.31        | — .63                       | .40                   | 13     | 11   | 55.0                             | 19           | 29.0  | 15              | 5     | ...                      |       |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 3.48        | + .43                       | 1.08                  | 28     | 15   | 53.0                             | 23, 24       | 25.0  | 11              | 14    | ...                      |       |
| XIII.  | Edinburgh (Royal Observy.) ..                                                                                                        | 1.07        | ...                         | .24                   | 20     | 17   | 55.4                             | 19           | 26.6  | 1               | 13    | 23                       |       |
| XIV.   | Colmonell .....                                                                                                                      | 2.50        | — .74                       | .60                   | 20     | 11   | 55.0                             | 19           | 23.0  | 10              | 12    | ...                      |       |
| XV.    | Tighnabruaich .....                                                                                                                  | 3.91        | ...                         | .75                   | 31     | 15   | 48.6                             | 23           | 25.0  | 10              | 23    | 21                       |       |
| „      | Mull (Quinish) .....                                                                                                                 | 3.95        | — .22                       | .94                   | 27     | 15   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 2.13        | — .45                       | .38                   | 8      | 13   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| „      | Dundee (Eastern Necropolis) ..                                                                                                       | 1.75        | — .23                       | .35                   | 28     | 18   | 53.4                             | 20           | 28.3  | 31              | 16    | ...                      |       |
| XVII.  | Braemar .....                                                                                                                        | 1.35        | — .97                       | .32                   | 22     | 14   | 52.3                             | 24           | 18.2  | 2               | 23    | 29                       |       |
| „      | Aberdeen (Cranford) .....                                                                                                            | 2.94        | + .74                       | 1.00                  | 28     | 18   | 51.9                             | 19           | 24.0  | 14, 23          | 16    | ...                      |       |
| „      | Cawdor (Budgate) .....                                                                                                               | .63         | — 1.61                      | .36                   | 22     | 8    | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| XVIII. | Glencarron Lodge .....                                                                                                               | 3.05        | — 3.89                      | .64                   | 21     | 18   | 51.9                             | 17           | 22.0  | 1               | 15    | ...                      |       |
| „      | Bendamph.....                                                                                                                        | 5.68        | — 2.43                      | .96                   | 13     | 15   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| XIX.   | Dunrobin Castle .....                                                                                                                | 1.53        | — .91                       | .53                   | 22     | 11   | 55.0                             | 19           | 25.0  | 1               | 14    | ...                      |       |
| „      | Castletown .....                                                                                                                     | 1.93        | ...                         | .47                   | 7      | 19   | 55.0                             | 19           | 24.0  | 1               | 17    | ...                      |       |
| XX.    | Killarney .....                                                                                                                      | 3.56        | + .36                       | .74                   | 21     | 14   | 57.5                             | 23           | 25.5  | 2               | ...   | ...                      |       |
| „      | Waterford (Brook Lodge)... ..                                                                                                        | 3.61        | + 1.09                      | .76                   | 20     | 20   | 56.0                             | 23           | 25.0  | 12              | 9     | ...                      |       |
| „      | Broadford (Hurdlestown) ...                                                                                                          | 2.51        | + .31                       | .60                   | 20     | 16   | 54.0                             | 19           | 28.0  | 1 <sup>b</sup>  | 7     | ...                      |       |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 2.29        | + .08                       | .73                   | 20     | 16   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| „      | Dublin (FitzWilliam Square) ..                                                                                                       | 2.09        | + .27                       | .52                   | 7      | 19   | 60.8                             | 19           | 28.9  | 11              | 3     | 13                       |       |
| XXII.  | Ballinasloe .....                                                                                                                    | 2.88        | + .46                       | .65                   | 20     | 19   | 64.0                             | 16, 19       | 18.0  | 2               | 15    | ...                      |       |
| „      | Clifden (Kylemore House).. ..                                                                                                        | 5.74        | + .55                       | .95                   | 27, 28 | 14   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| XXIII. | Seaforde .....                                                                                                                       | 2.41        | — .00                       | .57                   | 20     | 19   | 57.0                             | 19           | 23.0  | 10              | 14    | 17                       |       |
| „      | Londonderry (Creggan Res.) ..                                                                                                        | 2.12        | — .57                       | .39                   | 31     | 16   | ...                              | ...          | ...   | ...             | ...   | ...                      |       |
| „      | Omagh (Edenfel).....                                                                                                                 | 2.99        | + .41                       | .45                   | 20     | 17   | 55.0                             | 23           | 23.0  | 10              | 14    | 21                       |       |

+ Shows that the fall was above the average; — that it was below it. <sup>a</sup> and 11, 23. <sup>b</sup> and 10, 14.

## SUPPLEMENTARY RAINFALL, MARCH, 1904.

| Div.  | STATION.                       | Rain.<br>inches | Div.   | STATION.                      | Rain.<br>inches |
|-------|--------------------------------|-----------------|--------|-------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....    | 1·60            | XI.    | New Radnor, Ednol .....       | 2·60            |
| „     | Sheppey, Leysdown .....        | 1·48            | „      | Rhayader, Nantgwilt .....     | 3·05            |
| „     | Hailsham .....                 | 1·19            | „      | Lake Vyrnwy .....             | 2·82            |
| „     | Crowborough .....              | 1·36            | „      | Ruthin, Plâs Drâw.....        | 2·26            |
| „     | Ryde, Beldornie Tower.....     | ·93             | „      | Criccieth, Talarvor.....      | 2·61            |
| „     | Emsworth, Redlands .....       | 1·01            | „      | Anglesey, Lligwy .....        | 2·16            |
| „     | Alton, Ashdell .....           | 1·63            | „      | Douglas, Woodville .....      | 3·07            |
| „     | Newbury, Welford Park .....    | 1·56            | XII.   | Stoneykirk, Ardwell House     | 2·50            |
| III.  | Harrow Weald .....             | 1·59            | „      | Dalry, Old Garroch .....      | 4·18            |
| „     | Oxford, Magdalen College..     | 1·12            | „      | Langholm, Drove Road.....     | 5·93            |
| „     | Banbury, Bloxham .....         | 1·56            | „      | Moniaive, Maxwellton House    | 3·46            |
| „     | Pitsford, Sedgebrook .....     | 1·42            | „      | Lilliesleaf, Riddell .....    | 2·34            |
| „     | Huntingdon, Brampton.....      | 1·46            | XIII.  | N. Esk Reservoir [Penicuik]   | 3·05            |
| „     | Wisbech, Bank House .....      | 1·34            | XIV.   | Maybole, Knockdon Farm..      | 2·11            |
| IV.   | Southend .....                 | 1·36            | „      | Glasgow, Queen's Park .....   | 1·68            |
| „     | Colchester, Lexden.....        | 1·55            | XV.    | Inveraray, Newtown .....      | 3·77            |
| „     | Saffron Waldon, Newport...     | 1·40            | „      | Ballaculish, Ardsheal .....   | 5·89            |
| „     | Rendlesham Hall .....          | 1·44            | „      | Campbeltown, Redknowe...      | 2·41            |
| „     | Swaffham .....                 | 1·49            | „      | Islay, Eallabus .....         | 3·08            |
| „     | Blakeney .....                 | 1·40            | XVI.   | Dollar .....                  | 1·57            |
| V.    | Bishop's Cannings .....        | 1·57            | „      | Balquhider, Stronvar .....    | ...             |
| „     | Ashburton, Druid House .....   | 3·30            | „      | Coupar Angus Station .....    | 1·90            |
| „     | Okehampton, Oaklands.....      | 3·11            | „      | Blair Atholl.....             | 1·67            |
| „     | Hartland Abbey .....           | 1·87            | „      | Montrose, Sunnyside.....      | 2·11            |
| „     | Lynmouth, Rock House .....     | 3·28            | XVII.  | Alford, Lynturk Manse .....   | 1·96            |
| „     | Probus, Lamellyn .....         | 2·60            | „      | Keith, H. R. S. ....          | ·93             |
| „     | Wellington, The Avenue .....   | 2·08            | XVIII. | Fearn, Lower Pitkerrie.....   | ·41             |
| „     | North Cadbury Rectory .....    | 1·53            | „      | S. Uist, Askernish .....      | 2·48            |
| VI.   | Clifton, Pembroke Road .....   | 2·17            | „      | Invergarry .....              | 3·13            |
| „     | Moreton-in-Marsh, Longboro'    | 1·78            | „      | Aviemore, Alvie Manse.....    | 1·22            |
| „     | Ross, The Graig .....          | 1·70            | „      | Loch Ness, Drumnadrochit.     | 1·04            |
| „     | Shifnal, Hatton Grange.....    | 1·68            | XIX.   | Invershin .....               | ·80             |
| „     | Wem Rectory .....              | 1·59            | „      | Altnaharra .....              | 1·48            |
| „     | Cheadle, The Heath House.      | 1·73            | „      | Bettyhill .....               | ·48             |
| „     | Coventry, Kingswood .....      | 1·58            | „      | Watten, H. R. S. ....         | ·94             |
| VII.  | Market Overton .....           | 1·71            | XX.    | Cork, Wellesley Terrace ..... | 2·55            |
| „     | Market Rasen .....             | 1·79            | „      | Darrynane Abbey .....         | 3·41            |
| „     | Worsop, Hodsock Priory..       | 1·72            | „      | Glenam [Clonmel] .....        | 2·66            |
| VIII. | Neston, Hinderton.....         | 1·61            | „      | Ballingarry, Hazelfort .....  | 2·54            |
| „     | Southport, Hesketh Park...     | 2·02            | „      | Miltown Malbay.....           | 3·35            |
| „     | Chatburn, Middlewood .....     | 2·86            | XXI.   | Gorey, Courtown House .....   | 3·01            |
| „     | Duddon Valley, Seathwaite Vic. | 6·22            | „      | Moynalty, Westland .....      | 3·24            |
| IX.   | Langsett Moor, Up. Midhope     | 2·92            | „      | Athlone, Twyford .....        | 2·94            |
| „     | Baldersby.....                 | 1·72            | „      | Mullingar, Belvedere.....     | 3·38            |
| „     | Scalby, Silverdale .....       | 1·89            | XXII.  | Woodlawn .....                | 3·05            |
| „     | Ingleby Greenhow Vicarage      | 2·38            | „      | Westport, Murrisk Abbey..     | 3·02            |
| „     | Middleton, Mickleton .....     | 1·75            | „      | Crossmolina, Enniscoo .....   | 3·75            |
| X.    | Beltingham .....               | 2·24            | „      | Collooney, Markree Obsy...    | 2·46            |
| „     | Bamburgh.....                  | 1·77            | XXIII. | Enniskillen, Portora .....    | 2·86            |
| „     | Keswick, The Bank .....        | 3·39            | „      | Warrenpoint .....             | 2·87            |
| „     | Melmerby Rectory .....         | 1·80            | „      | Banbridge, Milltown .....     | 1·71            |
| XI.   | Llanfrechfa Grange.....        | 1·93            | „      | Belfast, Springfield .....    | 2·01            |
| „     | Treherbert, Tyn-y-waun .....   | 4·25            | „      | Bushmills, Dundarave .....    | 1·62            |
| „     | Llandoverly, Tonn .....        | 1·77            | „      | Stewartstown .....            | 2·33            |
| „     | Castle Malgwyn .....           | 1·68            | „      | Killybegs .....               | 2·32            |
| „     | Llandefaelog-fach .....        | 2·20            | „      | Horn Head .....               | 1·91            |

## METEOROLOGICAL NOTES ON MARCH, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunder-storm. R for Rain; H for Hail; S for Snow.

## ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The first week was practically sunless, with frequent but light R. From 8th there was a considerable amount of sunshine, and very little R until the last few days, when slight TSS occurred with some H. Duration of sunshine 62·3 hours and of R 41·7 hours. Mean temp. 40°·8, or 1°·3 below the average.

ABINGER HALL.—Moderately fine but not much sun. Ground wet and cold for seeds, and low germination. Sunshine greatly needed.

TENTERDEN.—Dull and cold generally but mostly dry. Wind N. and E., except about 14th, 21st and 28th, but not of much force. S on 1st, 2nd and 30th. Duration of sunshine 102 hours.

SHEPPEY, LEYSDOWN.—The first and last weeks were rainy and unsettled. Cold N.E. wind from 22nd to 27th. About 3 inches of S on 1st.

CROWBOROUGH.—R below the average and temp. low. From 8th to 23rd it was fairly mild, but the remainder was very cold. Mean temp. 39°·0. Prevailing wind E. and N.E. L, T, H, S and R on 30th.

HARTLEY WINTNEY.—Quiet and free from wind and dust. The first week was foggy and showery, followed by a dry and cold fortnight. Sleet showers in the last week and heavy H storm with T on 29th. Ozone on 20 days with a mean of 5·9.

WINSLOW, ADDINGTON MANOR.—Wintry weather at the beginning with S. Frost on many nights but never severe. Much H and rough wind on 30th.

PITSFORD.—R 28 in. below the average of 10 years. Mean temp. 39°·7.

COLCHESTER.—Almost continuous E. wind till 18th, with much sunshine but few warm days. The land was in excellent condition, but the season rather late.

BRUNDALL.—A fair average March, the mean temp. being only 0°·1 below the normal. Vegetation at the close was quite a month behind 1903.

WINTERBOURNE STEEPLETON.—Cold and dry, with mean temp. 2°·3 less than the average of 11 years. The wind was N. or E. for nearly the whole month. The dry weather was very beneficial for farm work.

TORQUAY.—R 56 in. below the average. Duration of sunshine 124·3 hours, or 15·3 hours below the average. Mean temp. 43°·4, or 0°·7 below the average. Mean amount of ozone 4·5.

LYNMOUTH.—The first week was cold, with S and R on 4th and 5th. T and L on 9th. In the middle of the month there was a good deal of sunshine. Gales from N.W. in the last week, and T and L at 8 a.m. on 29th.

WELLINGTON.—After the 9th set in one of the driest periods experienced for a considerable time, lasting for nearly three weeks. The last four days were stormy and unsettled.

NORTH CADBURY RECTORY.—Very seasonable; dry and unusually calm, with normal temp. and no strong wind. Except the first 7 and last 4 days the weather was very pleasant, and being practically rainless was of enormous benefit to agriculture.

CLIFTON.—R or sleet every day till 9th and very cold till 7th with N.E. winds and slight frosts. Then warmer with occasional slight R. Last few days stormy. Heavy TS from 6 to 7 p.m. on 9th.

ROSS.—The first week was wet and very cold, and from 8th to 23rd principally warm, fine and dry. Cold, rainy and unpleasant in the last week.

WORKSOP, HODSOCK PRIORY.—Dull and rather cold with normal R. Showers kept the ground moist and the proverbial "peck of March dust" did not appear.

BOLTON.—Cold, with N. or E. wind on 17 days. The R was below the average, and this, with the drying wind, was beneficial to agriculture. Mean

temp.  $37^{\circ}9$ , or  $1^{\circ}5$  below the average. Duration of sunshine 47.5 hours, the least on record.

**SOUTHPORT.**—Quiet, dull and rather cool, with high bar. and easterly airs. Mean temp.  $2^{\circ}0$  below the average. Duration of sunshine 29 hours less than the average, and R 1.2 in. below the average. Underground water exceptionally high. Remarkably little ozone.

**LLANFRECHFA GRANGE.**—Cold and wet, with very little dry wind. The land was too wet to work and grass not growing. Sharp T and L at 7 p.m. on 9th.

**HAVERFORDWEST.**—Commenced cold and frosty with a wintry sky, and although a few days were mild, it continued cold throughout, the max. temp. reaching  $50^{\circ}$  on only three days. Duration of sunshine 78.4 hours. Agricultural operations fairly well advanced.

**ABERYSTWICH, GOGERDDAN.**—The early part was dry but rough; the middle dull, wet and calm; but towards the end it became somewhat drier. Little sunshine.

**DOUGLAS.**—Cold, the temp. being persistently low throughout. Wet, very sunless and thoroughly unseasonable, with a remarkable absence of wind. Hardly a sign of spring and no fruit blossom.

#### SCOTLAND.

**CARGEN.**—Wet, cold and sunless, with vegetation very backward and farm work at a standstill.

**MAXWELTON HOUSE.**—Another cold month. Mean temp.  $37^{\circ}0$ , or  $5^{\circ}0$  below the average. The first half was cold and bright, the latter cold and wet, with a fine bright interval from 23rd to 27th. A backward season.

**LILLIESLEAF.**—R 1.8 in. above the average. There were two periods of cold: from 1st to 15th, and from 21st to the end. The S and cold winds were much against grass and garden growth.

**COUPAR ANGUS.**—R slightly below the average. Mean temp.  $38^{\circ}6$ , or  $1^{\circ}0$  below the average. Several severe morning frosts. Strong winds but no gales.

**DRUMNADROCHIT.**—R the lowest in 19 years, being 2.05 in. below the average of that period.

**ALTNAHARRA.**—Exceptionally fine, with bright sunshine for the greater part, but some storms towards the end.

**CASTLETOWN.**—The first part was cold, with S.E. winds, and S from 5th to 7th. The middle and latter part were fairly dry, with cold winds and some "March dust." Farmers were taking up last autumn's potato crop.

#### IRELAND.

**MILTOWN MALBAY.**—Not satisfactory for tillage. The last week was very rainy, with H and S, driven by squalls verging on storm force.

**DUBLIN.**—Generally cold and changeable. Mean temp.  $42^{\circ}7$ , or exactly that of January and  $0^{\circ}7$  below the average for March. Duration of sunshine 101 hours. H on 7 days.

**MARKREE OBSERVATORY.**—Very fine throughout, with frost on many nights. The last few days were very stormy, with H, sleet and frequent S.

**OMAGH, EDENFEL.**—Up to 27th the weather was generally clear, calm and rainless; many days would have done no discredit to the Riviera. Much grain was sown and farm work was proceeded with, but the inevitable change came towards the end and the weather for the last five days was literally terrible.

#### BATH METEOROLOGICAL OBSERVATIONS.

In the present number, observations at Bath appear for the first time in the Table on p. 56. It is convenient to place on record the values for the preceding months of 1904.

|               |      |     |     |    |    |  |      |    |      |    |   |   |
|---------------|------|-----|-----|----|----|--|------|----|------|----|---|---|
| January ..... | 3.20 | ... | .46 | 13 | 22 | \|\| | 55.0 | 13 | 23.2 | 23 | 5 | 8 |
| February..... | 3.61 | ... | .47 | 10 | 23 | \|\| | 54.0 | 21 | 24.5 | 29 | 2 | 6 |

## Climatological Table for the British Empire, October, 1903.

| STATIONS.<br><br><i>(Those in italics are South of the Equator.)</i> | Absolute. |                |          |                 | Average. |      |            |           | Absolute.    |                | Total Rain. |       | Aver.<br>Cloud. |
|----------------------------------------------------------------------|-----------|----------------|----------|-----------------|----------|------|------------|-----------|--------------|----------------|-------------|-------|-----------------|
|                                                                      | Maximum.  |                | Minimum. |                 | Max.     | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth.      | Days. |                 |
|                                                                      | Temp.     | Date.          | Temp.    | Date.           |          |      |            |           |              |                |             |       |                 |
| London, Camden Square                                                | 65·2      | 2              | 36·0     | 24              | 59·1     | 47·6 | 48·9       | 87        | 109·2        | 29·0           | 6·03        | 26    | 7·2             |
| Malta.....                                                           | 83·1      | 13             | 54·8     | 26              | 76·3     | 63·0 | 62·8       | 85        | 131·8        | 40·2           | ·25         | 3     | 3·3             |
| Lagos, W. Africa .....                                               | 88·0      | 31             | 70·0     | 17 <sup>b</sup> | 84·8     | 73·9 | 74·5       | 78        | 148·0        | 69·0           | 6·87        | 12    | 5·0             |
| <i>Cape Town</i> .....                                               | 78·0      | 22             | 38·5     | 18              | 63·9     | 49·1 | 50·2       | 78        | ...          | ...            | 3·73        | 15    | 5·8             |
| <i>Durban, Natal</i> .....                                           | 93·4      | 17             | 54·0     | 20              | 78·5     | 61·8 | ...        | ...       | 143·9        | ...            | 1·16        | 12    | 4·9             |
| <i>Mauritius</i> .....                                               | 82·0      | 23             | 57·2     | 6               | 78·7     | 63·2 | 59·9       | 69        | 147·2        | 48·4           | 1·20        | 20    | 5·9             |
| Calcutta.....                                                        | 90·9      | 4              | 66·9     | 27              | 87·0     | 74·9 | 73·9       | 80        | 155·0        | 61·7           | 8·02        | 14    | 5·7             |
| Bombay.....                                                          | 91·5      | 24             | 72·4     | 3               | 87·2     | 76·6 | 73·7       | 77        | 140·5        | 61·9           | 5·91        | 6     | 4·0             |
| Madras.....                                                          | 94·0      | 12             | 67·9     | 29              | 83·5     | 75·1 | 73·7       | 82        | 143·2        | 67·0           | 8·84        | 15    | 5·2             |
| Kodaikanal .....                                                     | 67·5      | 20             | 47·4     | 27              | 63·5     | 51·3 | 50·7       | 82        | 140·1        | 35·3           | 5·65        | 10    | 6·8             |
| Colombo, Ceylon.....                                                 | 89·6      | 14             | 72·8     | 16 <sup>c</sup> | 86·4     | 76·0 | 73·9       | 84        | 151·2        | 70·8           | 11·17       | 23    | 7·1             |
| Hongkong.....                                                        | 87·1      | 26             | 57·4     | 29              | 81·5     | 72·2 | 66·1       | 70        | 137·5        | ...            | 1·66        | 4     | 6·0             |
| <i>Melbourne</i> .....                                               | 87·7      | 11             | 40·8     | 3               | 70·2     | 50·8 | 48·7       | 69        | 149·8        | 31·6           | 2·77        | 14    | 5·9             |
| <i>Adelaide</i> .....                                                | 94·8      | 30             | 41·5     | 2               | 74·9     | 53·0 | 46·4       | 53        | 149·4        | 36·7           | ·66         | 9     | 4·7             |
| <i>Coolgardie</i> .....                                              | 89·1      | 25             | 39·2     | 9               | 75·3     | 48·7 | 43·0       | 49        | 158·1        | 29·7           | ·46         | 6     | 4·2             |
| <i>Sydney</i> .....                                                  | 77·9      | 13             | 48·8     | 4               | 66·6     | 55·3 | 54·3       | 77        | 116·0        | 43·4           | 4·12        | 19    | 6·4             |
| <i>Wellington</i> .....                                              | 72·4      | 23             | 42·0     | 5               | 63·9     | 50·7 | 47·4       | 70        | 133·0        | 29·0           | ·67         | 7     | 7·0             |
| <i>Auckland</i> .....                                                | 72·0      | 31             | 51·5     | 5               | 64·6     | 55·5 | 52·4       | 76        | 131·0        | 48·0           | 3·27        | 14    | 6·0             |
| Jamaica, Negril Point..                                              | 90·2      | 13             | 71·1     | 16              | 87·3     | 73·8 | 73·5       | 79        | ...          | ...            | 4·71        | 14    | ...             |
| Trinidad .....                                                       | 91·0      | 7 <sup>a</sup> | 68·0     | 9 <sup>d</sup>  | 89·2     | 70·7 | 74·0       | 82        | 166·0        | 66·0           | 2·12        | 5     | ...             |
| Grenada.....                                                         | 87·4      | 8              | 70·0     | 13              | 84·7     | 75·1 | 72·9       | 78        | 153·0        | ...            | 9·11        | 23    | 3·3             |
| Toronto .....                                                        | 73·9      | 7              | 27·9     | 27              | 59·5     | 42·1 | 45·1       | 78        | ...          | ...            | 2·78        | 10    | 5·7             |
| Fredericton .....                                                    | 71·3      | 1              | 34·9     | 30              | 53·6     | 34·9 | 34·1       | 62        | ...          | ...            | 4·14        | 11    | 6·1             |
| Winnipeg .....                                                       | 69·0      | 29             | 15·4     | 26              | 56·8     | 33·1 | ...        | ...       | ...          | ...            | ·69         | 5     | 4·3             |
| Victoria, B.C. ....                                                  | 65·7      | 12             | 37·3     | 3               | 57·0     | 45·5 | ...        | ...       | ...          | ...            | 1·77        | 14    | 6·4             |
| Dawson .....                                                         | 43·0      | 4              | 4·1      | 15              | 26·6     | 15·0 | ...        | ...       | ...          | ...            | 1·25        | 6     | 4·6             |

*a* and 8, 10. *b* and 21. *c* and 17. *d* and 10, 13.

MALTA.—Mean temp. of air 68°·3 or 1°·1 below, mean hourly velocity of wind 6·7 or 2·2 below, average. Mean temp. of sea 72°·7. L on 3 days.

*Mauritius*.—Mean temp. of air 1°·8, dew point 2°·0, and R 37 in. below, average. Mean hourly velocity of wind 12·1 miles, or 1·0 above average.

\* KODAIKANAL.—Mean temp. of air 55°·8. Mean velocity of wind 273 miles per day. Bright sunshine 135·9 hours.

COLOMBO, CEYLON.—Mean temp. of air 80°·5 or 0°·3 above, of dew point 0°·9 above, and R 3·39 in. below, average. Mean hourly velocity of wind 10 miles, prevailing direction S.W. TSS on 10 days.

HONGKONG.—Mean temp. of air 76°·1. R 3·70 in. below average. Bright sunshine 174 hours or 40 below average. Mean hourly velocity of wind 13·9 miles; prevailing direction N.E. by E.

*Adelaide*.—Mean temp. of air 1°·9 above, R 1·09 in. below, average. Moderately dry over agricultural areas.

*Sydney*.—Mean temp. of air 2°·5 below, humidity 8·2 above, and R 1·13 in. above, average.

*Wellington*.—Mean temp. of air 3°·7 above, and R 3·70 below average.

TRINIDAD.—R 4·65 in. below 40 years' average.

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## THE TRANSVAAL METEOROLOGICAL SERVICE.

WE have been favoured with the following authoritative account of the new Meteorological Service of the Transvaal, the Director of which is Mr. R. T. A. Innes. It is extremely gratifying to find how energetically the work is being carried on, and we feel sure that meteorologists in all countries will read these notes with interest and pleasure :—

In November, 1902, the Transvaal Government decided to establish a Meteorological department. The Director of the new department entered on his duties in April, 1903. Orders were at once sent to England for meteorological instruments for the second and third order stations. These arrived in the second half of 1903, and have been distributed. A site was secured for the observatory three miles north-east of Johannesburg, on a range of hills—it was partly purchased, but more largely presented, by the Bezuidenhouts, a Dutch family. The grounds cover  $10\frac{1}{2}$  acres, and are about 5900 ft. above sea-level. The observatory is now built.

There are already 200 rainfall stations in operation, in addition to about thirty stations of the second and third order. The rainfall observers send postcards on the morning after each rainfall. These observers have all come forward voluntarily. Many are farmers or school teachers, in thinly populated districts. Some 25 of the observers send daily weather telegrams to headquarters. Daily telegrams are also exchanged with the meteorological services of the neighbouring colonies, viz. : with Cape Town, Durban, Bloemfontein, and Salisbury, the first named including returns from half-a-dozen stations. A weather report, based on these telegrams, is issued every day at noon. The report appears in the evening journals. A letter code for telegrams has been introduced, which permits the observer to send the rainfall in three figures, state of sky, wind force and direction, prevailing weather, wet and dry bulb and maximum and minimum thermometers, barometer to thousandths of an inch, with attached thermometer, in a total of 16 letters.

Continuously recording instruments for the observatory are now on the way to South Africa, and it is hoped that they will all be in working order by the 1st of July next, the date of the commencement of the Transvaal meteorological year.

## THE VARYING DISTRIBUTION OF ATMOSPHERIC PRESSURE OVER THE SURFACE OF THE EARTH.

BY L. BONACINA.

THE precise distribution of atmospheric pressure that prevails at any instant of time over the Earth's surface must be regarded as the product of the following agents: (*a*) the distribution of the intensity of solar and terrestrial radiation over the surface of the globe; (*b*) the general circulation of the atmosphere; (*c*) the distribution of pressure that has previously prevailed; (*d*) the rotation of the Earth upon its axis.

When we consider these headings separately their meaning will be rendered clearer. With regard to (*a*) it is, of course, unnecessary to remark that all atmospheric changes have their ultimate origin in the sun's rays, which by exciting differences of temperature and of vapour tension, and consequently of pressure, set the air in motion, and thus engender the endless sequence of weather changes which it is the province of the meteorologist to investigate. Moreover, that the influence of terrestrial radiation is very considerable in modifying the distribution of atmospheric pressure is shown by the fact, that during the winter months over all the great continental land masses, which in virtue of the low specific heat of the rocks of which they are composed lose their heat very rapidly, pressure is relatively high,\* and remains so, till upon the advent of spring the solar rays gain sufficient power to dislodge the cold dense masses of air.†

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\* Over central Asia the mean barometric height during the month of January is above 30·5 inches, and over central North America above 30·2 inches. During the southern winter in the month of July pressure over Australia increases to 30·1 inches, over South Africa to 30·2 inches, and over Paraguay and northern Argentina to 30·1 inches. As, however, the continental lands of the southern hemisphere lie much nearer the equator, and cover a much smaller area than those of the northern hemisphere, the lowering of temperature over them is nowhere sufficient to render pressure higher than over the sea, and, accordingly, the anticyclones of the South Atlantic, South Pacific, and South Indian oceans retain their positions, but become increased both in intensity and size, expanding so as to embrace the continental lands within their influence.

† It must, of course, be remembered that a reduction of temperature over a given area involves an increase of atmospheric pressure only because the air over it contracts, sinks, and thereby receives accessions to its mass from above, there being at the same time an outward underflow at the surface of the ground. Similarly, a rise of temperature over any given area implies a decrease of atmospheric pressure in consequence merely of the fact that the expanded air overflows at higher levels, and thereby loses a portion of its mass, there being, meanwhile, an influx of air at lower levels to supply the deficit. If these conditions were not realised the air would simply expand or contract at constant pressure.

When the temperature of a mass of gas kept at constant volume is raised its pressure increases, because the kinetic energy of its molecules, the number of their impacts per unit time against the sides of the containing vessel, is increased. When at sunrise the temperature of the air rises, the first effect is

With regard to heading (*b*) little more can be said than that the general circulation of the atmosphere is *ipso facto* responsible for the complex nature of that circulation, and that the cyclonic eddies, which are constantly disturbing the atmosphere, originate in the forward motion of the air as a whole. Of the mathematical laws upon which this complex circulation depends we are, of course, profoundly ignorant.\*

Under heading (*c*) we have to discuss what is undoubtedly the cause of the variability in the character of the weather experienced during corresponding seasons of different years. Why does not precisely the same distribution of atmospheric pressure prevail all over the globe at corresponding dates every year when the Earth is in the same relative position with regard to the sun, and when, therefore, the atmosphere might be expected to circulate in the same manner, that is to say to produce similar eddies in the same places? Obviously the reason is that the distribution of pressure that prevails at any instant of time is, in some obscure manner, dependent upon the distribution which preceded it, and is in turn responsible for the type of distribution that will succeed it; in other words, we are forcibly driven to the conclusion that had the weather that prevailed, for example, ten years ago been of a different character, so likewise would the general character of the weather we are now experiencing be somewhat different. The knowledge of this dependence of one type of weather upon another is, of course, of little use to us in the work of forecasting weather changes, because we do not know *how* one type is related to another.

The difficulties which beset us when we endeavour to ascertain how, for example, the easterly type of weather that may have been conspicuous in England one month was related to the westerly type that may have prevailed the previous month, or how, again, a cyclone situated over the British Islands is related to an anticyclone that may be dominating the atmospheric conditions over Australia, are well nigh insurmountable. Moreover, when we discuss the minutiae of synoptic charts we find that the various forms of distribution of atmospheric pressure, although capable of classification under a few well-marked types, are really infinite in number. Two synoptic charts, for example, constructed on two occasions, separated by a longer or shorter interval of time, might reveal a distribution of pressure so similar, that we should be tempted to base our predictions upon the second occasion upon our experience of the changes which followed after the first occasion. Yet there would be slight

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an increase of atmospheric pressure, but afterwards as the rise of temperature continues and the air expands and overflows, pressure decreases in consequence of the greatly diminished density of the air, the fall of pressure from this cause being greater than is counterbalanced by the increase due to the higher temperature. [But see this Magazine, Vol. 36 (1901), p. 93. Ed. S. M. M.]

\* When we reflect upon the infinite complexity of the motion of the water of a mountain torrent, for instance, need we wonder that the movements of the atmosphere are indeed inexplicable?

differences between the distribution of pressure on these two occasions, not indicated by the charts, that might suffice to be the precursors of quite a different set of atmospheric changes, and finally of the establishment of opposite types of weather. This is the chief source of the failures which discredit the science of weather prognostication. Moreover, as it is impossible to construct weather charts showing the simultaneous distribution of pressure over every small portion of the Earth's surface, we shall never be able, by the method of synoptic charts, to forecast atmospheric changes with the near approach to certainty with which we can predict the occurrence of many astronomical phenomena. We are now able to establish the following proposition: every locality would experience the same weather at corresponding times every year when its position with regard to the sun is the same, if it were not for the fact that one type of pressure distribution is *à posteriori* related to that which prevailed previously. In other words, it is this unknown relationship that causes, for instance, the character of two successive winters in England to be so dissimilar, and which prevents any two seasons, however similar, from being absolutely alike.

The cold wet summer which characterised the year 1903 in Britain was, so far, related to the mild open winter which preceded it, that any difference in the general character of the latter would have necessitated a difference in the general character of the former in accordance with the unknown laws which control the sequence of weather types. Since, however, one type of weather merges by insensible gradations into another, and since the various forms of distribution of atmospheric pressure are, when minute differences are taken into consideration, numerically infinite, so that at no two points of time have the atmospheric conditions over the globe ever been identical (though, of course, often very similar), it is manifestly impossible to predict the weather of a coming season. If, for example, we were to experience another winter very similar to that of the year 1903 we should not be justified in expecting the following summer to resemble that of the year 1903, inasmuch as small differences between any two seasons are adequate to produce quite disproportionate differences between the succeeding seasons.

Finally, under heading (*d*) we shall consider the potent influence exerted by the rotation of the Earth upon its axis in modifying the general circulation of the atmosphere, and therefore the distribution of barometric pressure.

The effect of the rotation of the Earth upon any current of air is to cause it to deviate to the right in the northern hemisphere, to the left in the southern, of the direction in which it would travel were it subjected to the influence of the disturbing force alone. If it were not for the axial rotation of the Earth, cyclonic disturbances, such as we know them, would not exist, for whatever may be the cause of the initial reduction of pressure, which renders the formation of cyclones possible, it is the rotation of the Earth, which by causing

the wind to heap up masses of air to the right of its path (to the left south of the equator) greatly exaggerates the original atmospheric depression, and increases both the size and intensity of low-pressure systems.† Moreover, the great anticyclonic centres, situated more or less permanently over the oceans in about latitude 30° N. and S., owe their origin to the axial rotation of the Earth. In conclusion we would observe that the retardation of the rotation of the Earth upon its axis, caused by the oceanic tides raised by the moon, must be extremely slowly modifying the circulation of the atmosphere, and consequently the climatic conditions of the planet.

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Correspondence.

To the Editor of Symons's Meteorological Magazine.

SOME WEATHER PROPHETS.

I QUITE agree with Mr. William Ellis, F.R.S., as to the inadvisability of publishing *crude and ill-considered theories* upon any subject, especially that of Meteorology, in which *great ignorance is shown of the conditions of the weather problem, as well as of the proper method of treating it* among scientific men, especially those connected with the Royal Society, the Greenwich Observatory, and the Royal Meteorological Society.

Mr. Ellis is wrong if he thinks (as he appears to do) that he possesses complete knowledge on the subject. I should like to know who told him, and upon what authority he asseverates, that the moon does not attract the atmosphere. He gives no proof for this dogmatic assertion. He says rightly that the water of the ocean is attracted by the moon, but he excludes the ocean of air from that attraction, and it appears also the solid Earth, for he ridicules the idea that the moon can have any influence in the production of earthquakes and volcanic eruptions. The atmosphere, the hydrosphere, and the lithosphere are all composed of matter and are obedient to the great law of universal attraction, under which law every particle of matter attracts every other particle of matter directly as the mass and inversely as the square of the distance. This is the Newtonian law, but it appears Mr. Ellis has a law of his

† When once the essential condition for the formation of a cyclonic eddy, namely, a slight diminution of pressure, has been established, the atmospheric depression is further increased by (a) the rotation of the Earth, (b) the ascending motion of the air, (c) centrifugal force. Theoretically the air, in some portions of a cyclone, must be in a compressed state; the effect of this must be (1) to increase the steepness of the barometric gradients, (2) to render pressure in the portion where aërial compression exists higher than it otherwise would be, the increase of pressure due to compression serving to counteract the much greater reduction of pressure which, from other considerations, we should expect to observe in a cyclone.—(See P. Marc Dechevrens, "Les Variations passagères de la Température," pp. 29 and 30.)

own, denying the properties of matter to the atmosphere. This Elysian law is the outcome of his complete knowledge of the laws of Nature, and gives him the authority to teach other more benighted individuals that weather is not the result of the attraction of the atmosphere by the combined influences of the moon and sun, but that all weather changes are caused by the heat of the sun. This is altogether erroneous teaching, as the sun's heat is used up in the process of radiation and the work done in evaporation, by which, at enormous expense of solar heat, the particles of water are separated against the cohesive power binding them together. By my work and experience I have found that the amount of solar heat is constant, and that the variations of temperature on the Earth's surface are due to the varying amounts of sun's rays cut off by tidally produced clouds.

During the last twenty years I have correctly predicted the weather for both long and short periods. A man like Mr. Ellis, who professes to believe that I predicted the weather correctly for 153 successive days by mere guessing, is capable of believing anything.

Science admits no authority, no dogmatism, like that of Mr. Ellis and the sun's heat, but deals with facts based upon experiment and verification. The late Mr. Symons stated that we should gladly receive the solution of the great weather problem from any person. Now I claim to have solved the problem of not only weather changes but also the incidence of great tides and earthquakes. In fact, I have found and proved by experiment that the atmosphere, the hydrosphere, and the lithosphere are tidally affected by the moon and the sun. And in order to establish this fact, I am prepared to predict the weather correctly by the tidal action of those great luminaries for any day or days in the future, if Mr. Ellis will be good enough to form a committee to adjudicate upon the result.

HUGH CLEMENTS.

WITH much that Mr. Ellis says in his paper on "Some Weather Prophets," one may heartily agree. But there are two passages which seem to call for protest. He says (p. 46) that "by no known method, by reference to no celestial body whatever, can the character of the weather, for any length of time in advance, be foretold"; and he wonders apparently at the stupidity of those who "can persevere in a task at present so utterly hopeless as the endeavour," &c. Now, we have surely got beyond this. Is it not a fact that this forecasting of distant weather (one of the great aims, surely, of meteorology) is a problem regarded by many of our leading men with considerable hopefulness? Why this growing interest in the question of sunspots and weather, if there is not some reasonable hope of establishing definite relations between these, and, as a result, gaining light on future weather? Here, *e.g.*, are three names whose eminence none will dispute—Buchan, Eliot, Von Bezold. Dr. Buchan,

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we know, has recently offered evidence that the rainfall in Scotland is ruled by the sun-spot cycle (most rain with maxima). Sir John Eliot, as you tell us (p. 55), thinks "the next development of weather study will almost certainly be in the relation of meteorology to the phenomena of sun-spots and terrestrial magnetism." Again, at a recent triennial gathering of meteorologists in Germany, I find the president, Professor von Bezold, saying, very similarly, that "among the most important tasks of the near future is the explanation of the connection between the sun-spot frequency and terrestrial temperature." Can it be said, in view of such facts, that the forecasting of distant weather is a problem "utterly hopeless"?

Again, we are favoured, once more, with that old, but not (I think) venerable, syllogism: Weather changes are exclusively an effect of heat; the moon gives no sensible heat; therefore the moon has nothing to do with weather changes. It is difficult to see how anyone can know all that. But what I wish rather to call attention to is, that hopeful interest in the moon as a factor in weather seems also to be growing. I might cite Dr. Russell, of Sydney Observatory, as having recently argued for lunar influence. And in the newspaper account of the German meeting (already quoted) I read that Prof. Möller, of Brunswick, lectured on the atmospheric flow and ebb movements as connected with the moon. &c., and Prof. Börnstein, of Berlin, demonstrated on a paper model how the air pressure varies with different lunar phases and positions of the sun.

There is, in truth, a growing body of evidence of lunar action; and unless we are to suppose many able minds strangely misled, we may reasonably demur to that summary dismissal of the subject which your critic recommends to us.

A. B. M.

I HAVE read the letters of Mr. Hugh Clements and of A.B.M. The principal impression produced is that they might to some extent have been couched in more courteous language. Otherwise there seems to be little to remark. I can only suggest some further study of what is set out in the article that appears in the April number of the Magazine. To have supported by evidence the statements contained therein would have occupied much more space than was likely to be at my disposal, besides this was scarcely necessary, since they refer to what is common knowledge in the scientific world, as depending on the proper discussion of observed facts.

A few words may, however, be added on some misconceptions. I have not said "that the moon does not attract the atmosphere." The discussion of barometric observations at St. Helena by Sabine, and at Singapore by Elliot, given in papers appearing respectively in Vols. 137 and 142 of the *Philosophical Transactions*, shows that the total lunar effect is less than the one-hundredth part of an inch: an amount altogether insignificant as compared with other disturbances to which the atmosphere is subject. It was not mentioned by

me because so minute an effect could be of no conceivable use in the practical forecasting of weather. Neither did I ridicule the idea of the moon having "influence in the production of earthquakes and volcanic eruptions." I say they cannot be predicted so accurately as eclipses of the sun and moon, which Mr. Clements seems to claim. Further, I have in no way suggested that any of Mr. Clements' predictions were mere guessing. I simply wished to show that if the weather were set down, day by day, at random, how not unfrequently there might be such agreement as would lead some people (whom a few coincidences seem to convince) to suppose that the predictions were the result of scientific method. Again, like the late Mr. Symons, I would gladly see the solution of the great weather problem. But I am not aware that any solution has yet been arrived at by which weather can be predicted for long periods in advance.

A. B. M. asks in his letter whether the forecasting of the weather is not a problem to be entertained "with considerable hopefulness." Certainly, as a thing to be desired, but at present we are a very long way indeed from anything of the kind, and future weather remains yet an unsolved problem. This does not mean that we do not all honour the well known and revered names, cited by A. B. M., of those who have distinguished themselves in the endeavour to deduce from recorded observations some general laws in regard to relations that may or may not exist between sun-spots, magnetism, and other terrestrial phenomena. Their work and revelations on such matters are of the highest value, but not one of these scientists would presume to say that our present knowledge on the matters mentioned is of any practical value whatever in regard to any accurate forecasting of weather. Indeed, their object is really more the independent investigation of Nature's laws, without special regard to their use in forecasting. With respect to the question of heat received from the moon, A. B. M. gives a sentence which might be understood as a quotation from my article, but he does not give my words. I did not say "that weather changes are exclusively an effect of heat," neither did I say "that the moon has nothing to do with weather changes," but that I considered that lunar influence had not been definitely traced. And as regards the moon giving no sensible heat, if I am not mistaken the Earl of Rosse is one of those who have made and published observations thereon.

The outcome of the whole matter is, that whilst many minds are discussing many meteorological questions, nothing has yet been discovered that in any degree helps the forecasting of weather for long periods in advance. It is still only possible to do so for one or two days in advance, not from theoretical considerations, but simply from knowledge of the existing conditions of weather daily telegraphed from a great extent of country to the meteorological establishments of different nations. And there I leave the matter, desiring no prolonged discussion thereof.

WILLIAM ELLIS.

Blackheath, May 7, 1904.

[Proofs of the two letters criticising Mr. Ellis were forwarded to him, and his reply is given above. Each writer is responsible for his own statements, which are printed in exact accordance with the proofs received from them. The correspondence confirms our feeling of gratitude to Mr. Ellis for expressing the outcome of his long experience and profound study of both meteorology and astronomy. The warning will not, we believe, fail to be of service to less experienced students. We will gladly welcome new light on any meteorological problem from any source, provided that the reasoning which conveys it is intelligible to us, and that the claimant to discoveries is willing to work out fully some portion of his chain of argument, and is not content merely to throw out fragmentary suggestions.—ED. *S.M.M.*].

THE REMARKABLE DARKNESS OF APRIL 15th.

YOU probably have had information already of the phenomenal darkness of last Friday, 12.25 p.m., but I should be glad to know if there is any explanation as I never saw anything quite like it, yet I see no notice of it in the press.

(1.) It came from S.W. quickly, and therefore was not smoke cloud.

(2.) It resembled, while passing over, a tunnel (of darkness) with light visible at either end, and lasted 10 minutes.

(3.) It was not accompanied by thunder or rain, but with puffs of wind from S.W.

It was too dark to go on with garden work, even in the open, for 10 minutes.

Do you think the darkness was from snow clouds?

STANLEY SINGLE.

*Park View, Leopold Road, Wimbledon,
April 18th, 1904.*

PARASELENE.

AT 10 p.m. on the 20th April a white lunar cross was visible here, like the inner cross shown in *Meteorological Magazine*, 1895, p. 123. The upper arm or pillar was about five lunar diameters in length, the side arms were three diameters, and the lower arm two diameters in length. At 10.30 only the upper arm was visible, much reduced in length and very slightly iridescent; shortly afterwards the moon disappeared behind a cloud. The time of moonset was 11.49 p.m.

Possibly, before I saw it the halo may have been more perfect.

J. P. MACLEAR.

Chiddingfold, Surrey.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, April 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Capt. D. Wilson-Barker, F.R.S.E., President, in the chair.

Mr. G. B. Clough, Mr. H. N. Farrington, Mr. I. Goetz and Mr. A. E. Heyer were elected Fellows of the Society.

A paper by Mr. J. B. Cohen on "The Cause of Autumn Mists," was, in the absence of the author, read by Dr. W. N. Shaw. The author described some experiments which he had carried out on Coniston Lake in September, 1900. Two minimum thermometers were attached horizontally to the top and bottom of a stout board, which was floated on the water. The experiment was made about midnight, when a heavy mist hung over the water, and the thermometers were floated half-way across, and about half a mile from the head of, the lake. The depth of water was 22 feet, and the bottom temperature $57^{\circ}\cdot 2$. By this arrangement of thermometers, the temperature of the surface water and of the air in contact with it was taken simultaneously. It is clear that if any cooling of the surface water occurred, the cooler water would at once sink. The following are the results of two experiments:—

Experiment 1	Air $48^{\circ}\cdot 2$	Water $60^{\circ}\cdot 8$	Difference $12^{\circ}\cdot 6$
„ 2	„ $46^{\circ}\cdot 4$	„ $60^{\circ}\cdot 8$	„ $14^{\circ}\cdot 4$

The point which appears to have escaped attention is that the phenomenon of autumn mist is accompanied by a difference of temperature of the air, which is warmer in the upper region of the atmosphere than at lower levels. The following temperatures were taken at different heights before sunrise on September 15th and 16th, 1900. The thermometers were suspended about 3 feet from the ground without any screen.

Lake Level		Sept. 15... $47^{\circ}\cdot 3$	Sept. 16... $46^{\circ}\cdot 4$
Slope of Coniston Old Man... 1750 ft.	„	$51^{\circ}\cdot 8$	„ $49^{\circ}\cdot 6$
Summit of Coniston Old Man 2600 ft.	„	$52^{\circ}\cdot 7$	„ $50^{\circ}\cdot 9$

Thus, there was a difference in the one case of $5^{\circ}\cdot 4$, and in the other of $4^{\circ}\cdot 5$, between the lake level and the summit. All the lower ground as far as the horizon lay immersed in a perfectly level sea of purple mist, through which the peaks of the higher hills projected, forming, as it seemed, little scattered islands which were quite clear and sharply defined. Moreover, there was scarcely any dew either on the grass or stones on the summit, whereas it lay very thick everywhere at the level of the lake.

The explanation which seems to follow from the above observations is, that after sunset in still weather the higher ground as it passes into shade begins to cool by radiation, and to cool the air in contact with it, which becomes denser and flows down to a lower

level. The cold air on coming into contact with the warm moist air above the lake and surrounding ground, cools the latter below the dew-point and produces mist. The densest mist will naturally be found above damp ground or over water, which is precisely what occurs. Not only so, but if the sheet of water is long and narrow, with hills sloping down on both sides, as at Coniston, a thin column of mist will form where the stream of mist from both hillsides meets in the middle. This phenomenon is easily observed on Coniston lake by any one sitting in a boat an hour or two after sundown. At the same time a steady stream of mist may be seen flowing towards the lake from the adjacent meadows.

As the process continues, the whole basin of the valley fills with mist, which will go on rising until only the hill-tops remain visible, giving rise to the effect seen from the summit, and already described. After the sun has risen the mist clears, and the ground is found to be covered with a heavy dew. The dew is, however, not true dew in the sense that it is not produced by the deposition of moisture rising out of the ground and condensed by contact with a cold surface; but is formed by the deposition of drops of water suspended as mist in the air. That this is the case was easily shown by mooring a tin dish containing a freshly cut sod free from dew some distance from the shore of the lake whilst mist was forming. As the mist probably prevents radiation from the grass blades of the sod, the sod must rather gain than lose heat by contact with the water surrounding the dish, which is warmer than the air. Yet, before sunrise the following morning, the blades of grass in the dish were covered just as plentifully with dew as the grass of the surrounding meadows. If this occurs on the water, it is more than probable that a similar process takes place on the surrounding land.

An interesting discussion followed the reading of this paper, in which the President, Dr. W. N. Shaw, Dr. H. R. Mill, Mr. F. Campbell Bayard, Mr. R. G. K. Lempfert, Mr. W. Marriott, Mr. H. Southall, Mr. Baldwin Latham, Mr. J. E. Clark, and Mr. J. Hopkinson took part.

The second paper was by Mr. W. L. Dallas, on "The Variation of the Population of India compared with the Variation of Rainfall in the decennium 1891-1901." The author showed that during the 4 years 1891-5, the rainfall was generally normal or heavy over nearly the whole of India, and during the 6 years 1895-1901 the rainfall was greatly deficient. During the former or "wet" period the rainfall was deficient over Upper Burma and Madras, was normal over the remainder of Burma, Assam, Bengal, and the West coast of the Peninsula, and was excessive elsewhere; while during the latter or "dry" period the rainfall was again deficient over Upper Burma, normal or excessive over the remainder of Burma, Assam, Bengal, the United Provinces, the North-West Frontier Province, and the South of Madras, and was deficient elsewhere—most so over Rajputana and neighbouring areas.

The general Census of India taken on March 1st, 1901, showed the total population to be 293,475,477, which, excluding the territories not included in the Census of 1891, was an increase of only 1·3 per cent. The population has thus failed to increase according to the normal rate during the decade. Part of this failure was no doubt due to epidemics. The author, however, shows that there is an unmistakable relationship between the variations of the population and the variations of rainfall during the 6 dry years. The area within which the most serious decrease of population occurred coincides almost exactly with the area of greatest deficiency of rainfall.

The discussion of this paper was postponed until the next meeting of the Society.

REVIEWS.

Report of the Meteorological Council for the year ending 31st of March, 1903, to the President and Council of the Royal Society. Presented to both Houses of Parliament by Command of His Majesty. London: Eyre and Spottiswoode, 1904. Size 9½ × 6. Pp. 180. Price 11d.

ONE instinctively looks forward to the publication of the annual report presented by the Meteorological Council to the body by which it is elected and to which it is responsible. Though a long time elapses before the King is able to command its presentation to both Houses of Parliament, by one of which the money for carrying on the work is voted, the taxpayer, who ultimately pays for it all, at length is privileged to purchase for less than a shilling this record of the transactions concluded rather more than a year before. The Report has a long way to travel, and must obtain the approval of many august bodies and personages before it reaches the public, yet though it speaks of events of last year in the future tense, it retains a certain amount of freshness, and presents several features of interest to meteorological observers. The interest would have been far greater if the Report could have appeared earlier.

Amongst the points referred to in the Report are the incorporation of the climatological stations reporting to the Registrar-General with the general climatological organization of the Meteorological Office, and the increased correspondence with the meteorological departments of the Colonies.

We learn that Mr. P. Y. Alexander, of Bath, had offered to lend a balloon for experiments at the National Physical Laboratory on the temperature of the free air up to 1000 feet on calm days, but unfortunately when it was tried the weather was only approximately calm, and the balloon becoming free proceeded to the north coast of France and was recovered in a somewhat damaged condition.

We regret to see that the efforts to arrange for wireless telegraphic reports of pressure from Atlantic steamers through Lloyd's signal stations were fruitless, but we gather that this was in no way the fault of the Council.

During the year reported on the staff of the Meteorological Office was strengthened by the appointment of Mr. R. G. K. Lempfert, of Emmanuel College, Cambridge, as special scientific assistant to the Secretary. But it has suffered a loss through the retirement of Mr. Frederic Gaster, who had been in charge of the Forecast and Storm Warning Branch since 1868. Everyone who has had the privilege of knowing Mr. Gaster will cordially concur in the praise which the Council bestows on him after his long service.

The completely successful forecasts made at 8.30 p.m. amounted to 53 per cent., the partially successful to 35 per cent., the partial failures to 10 per cent., and the complete failures only to 2 per cent. This result for 1902 was better than for any of the last ten years. Of the storm warnings only 6 per cent. failed to be justified by the subsequent weather.

A History of the Daubeny Laboratory, Magdalen College, Oxford . . . by R. T. GÜNTHER, M.A., F.Z.S. London: Henry Fronde, 1904. Size 9 × 5½. Pp. viii.+138. Price 5s. net.

IN 1848 Dr. C. G. B. Daubeny, Professor of Chemistry, Botany and Rural Economy in the University of Oxford, built a laboratory and class-room adjoining the Physic Garden at Oxford on ground belonging to Magdalen College. The double professor (he had resigned the chair of Chemistry in 1854) died in 1867, and left all his collections to Magdalen College, together with a sum of money to provide the salary of a curator. In 1869, Mr. Edward Chapman, now M.P. for the Hyde Division of Cheshire, was appointed Lecturer on Natural Science, a position which he held until 1894, and he has since succeeded by the author of this interesting little history.

Meteorological records were started by Dr. Daubeny in 1861, but they were made by himself wherever he happened to be, at home or abroad, so that so far as Oxford is concerned the record is a broken one, and the fact that the observations lapsed at his death is of little importance. In 1868 they were resumed in a more systematic way, and in 1869 they came under the charge of Mr. Chapman, and have since been maintained in a state of efficiency. The shade thermometers, however, are not exposed in a standard screen, but placed against a north wall, and since 1873 observations have been made at 10 a.m. instead of the standard hour of 9 a.m. This makes it impossible to compare the results with other stations. There are two rain gauges, one at the standard height of 1 foot above ground and 190 feet above sea-level, the other on a roof 20 feet higher. There are also two river gauges in the Cherwell, and the temperature of the water in the river is recorded each morning. The observations on river temperature proved most useful when a Committee of the British Association was engaged on an investigation on the temperature of exposed water surfaces about twelve years ago. The monthly means for each year since 1882 are published in this volume,

and we reprint the summary table comparing the data for two nearly equal periods. It will be noticed that the difference between the water and air temperature remains practically the same, but that the mean rainfall of the second period is more than 2 inches less, and the mean temperature of both water and air one degree higher than in the first period. In the table the figure I. refers to the means for the ten years 1882-91, the figure II. to the means for the twelve years 1892-1903.

Mean Temperature of River Cherwell at Oxford.

MONTH.	Mean Air Temperature for Day.		Mean River Temperature, 10 a.m.		Excess of River over Air Temperature.		Average Rainfall in inches.	
	I.	II.	I.	II.	I.	II.	I.	II.
January	37 ^o ·6	38 ^o ·4	37 ^o ·8	38 ^o ·4	0 ^o ·2	0 ^o ·0	1·87	1·49
February ...	38·6	39·2	39·5	39·3	0·9	0·1	1·66	1·48
March.....	40·6	42·5	41·9	43·2	1·3	0·7	1·48	1·27
April	45·9	48·5	48·3	50·7	2·4	2·2	1·80	1·37
May.....	53·1	53·8	55·4	56·9	2·3	3·1	2·05	1·35
June	59·6	60·5	61·6	63·2	2·0	2·7	2·17	1·95
July	62·3	64·2	64·6	65·7	2·3	1·5	2·58	2·33
August	61·3	62·6	63·1	63·8	1·8	1·2	2·00	2·48
September ...	57·2	57·5	58·8	59·7	1·6	2·2	2·16	1·78
October	48·9	49·7	50·0	50·9	1·1	1·2	2·73	2·83
November	43·1	44·3	43·4	44·3	0·3	0·0	2·47	2·11
December ..	37·4	39·7	38·4	39·7	1·0	0·2	1·97	1·98
YEAR	48·9	50·0	50·3	51·3	1·4	1·3	24·94	22·42

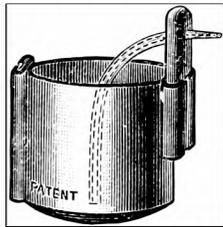
Geographen-Kalender. In Verbindung mit DR. WILHELM BLANKENBERG, PROFESSOR PAUL LANGHANS, PROFESSOR PAUL LEHMANN und HUGO WICHMANN, herausgegeben von DR. HERMANN HAACK. Zweiter Jahrgang: 1904-1905. Gotha, Justus Perthes. Size 6½ × 4. Pp. 360. Portrait and Map. Price 4s.

THIS publication, now in its second year, claims to be a geographical "Who's Who?" and, as Geography is taken in its widest sense, it includes Meteorology. The previous issue gave a directory of about 5000 persons interested in the geographical sciences in all parts of the world, including the authors of all papers on meteorology who could be traced; the current issue gives a list of about 3000 institutions and societies and 2000 periodicals of similar aims. Although mainly in German, all the statistical tables are printed also in English and with the units familiar in English-speaking countries. There is no other work covering the same ground, and it should prove useful to meteorologists. The little book is very neatly got up and contains an engraved portrait of Sir Clements Markham.

THE DITTMAR RECORDING PEN.

AT the request of Mr. William Dittmar we have recently made a trial of a new form of pen for use with recording instruments, which he has patented. The particular pen was specially adapted for use on the Redier Barograph, but in principle it differs in no way from the ordinary form, as shown in the accompanying sketch. The pen may be used for any sort of recording instrument, and is particularly useful where absence of friction is a desideratum, as it works without any pressure on the paper.

The pen consists of a tiny cup to hold the ink, and an excessively fine capillary tube dipping nearly to the bottom, and drawn out to a point projecting at right angles from the side of the cup. When the cup is filled with ink the capillary tube may be filled by slight suction by means of an ordinary fountain-pen filler, and once filled it holds the ink, allowing it neither to run back into the cup nor to form a drop at the point. The maker claims the following among other advantages:—The pen records, in any direction, a line of equal breadth; a record can be taken at any desired speed; the ink only flows when the pen moves across the paper; the pen requires no attention when once started. We have found that the claim is fully justified, the line drawn being particularly fine, clear, and of uniform blackness. Observers who have been troubled by the unsightly dripping from some of the unsatisfactory types of recording pen will appreciate Mr. Dittmar's invention.



METEOROLOGICAL NEWS AND NOTES.

THE ROTHESAY METEOROLOGICAL RECORDS are amongst the oldest in the United Kingdom, and it is with regret that we read in the *Buteman* of April 23rd of their "threatened abandonment." We cannot believe that the historic interest in meteorology has so completely departed from Scotland as to permit such a suggestion to be carried out. Mr. Kay has performed a splendid service by keeping the record for 28 years, and deserves the greatest credit for his scientific zeal and public spirit. Now, when he finds it necessary to retire, we trust that some of his townsmen, or the Corporation itself, will see to the continuity of this record of 104 years.

BRITISH RAINFALL 1903, is now so far advanced that additional returns should be forwarded to the Editor within a week if they are to be utilized in the discussions. Amongst the returns received, there is one giving only the total of 43.60 in., but no other information; neither place nor name of observer, nor a word of handwriting, the envelope having a printed address. To complete the puzzle, the Post Office, which has done much to hamper the collection of rainfall statistics, succeeded in impressing a post-mark of which no single letter was legible! Did any of our readers record such a rainfall?

RAINFALL AND TEMPERATURE, APRIL, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.]	RAINFALL.					Days on which '0' or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours.		Max.		Min.		Shade	Grass		
				Depth.	Date.	Deg.		Date.	Deg.			Date.	
I.	London (Camden Square) ...	1.01	— .51	.37	22	10	67.9	14	36.2	11	0	7	
II.	Henterden	1.22	— .55	.37	12	10	66.0	14	33.0	22, 26	0	7	
	Hartley Wintney	1.36	— .28	.40	15	14	67.0	19	33.0	26	0	6	
III.	Hitchin .....	.81	— .71	.24	22	10	64.0	14, 18	35.0	17	0	...
	Winslow (Addington)	1.05	— .51	.28	15, 22	12	65.0	14	33.0	11	0	10	
IV.	Bury St. Edmunds (Westley) .....	.87	— .66	.28	12	9	64.5	18	31.5	22	...	...
	Brundall .....	.86	— .65	.37	22	11	68.6	15	32.8	22	0	4
V.	Alderbury	1.08	— .69	.17	2	13	58.0	16a	32.0	1, 6	2	...	
	Winterborne Steepleton	1.35	...	.35	15	12	64.0	20	32.0	11	1	6
	Torquay (Cary Green)	1.09	...	.37	13	12	63.3	24	37.6	17	0	6
	Polapit Tamar [Launceston]	1.99	— .17	.54	13	18	61.3	19	31.0	26	2	2	
	Bath	1.80	...	.32	22	14	63.2	18	33.8	17	0	...
VI.	Stroud (Upfield)	1.23	— .61	.21	15	15	63.0	18, 30	37.0	10	0	...	
	Church Stretton (Woolstaston)	1.64	— .24	.35	22	16	63.5	24	...	...	...	...
	Bromsgrove (Stoke Reformatory)	1.24	— .11	.26	14	10	61.0	18	...	...	...	...
VII.	Boston .....	.74	— .64	.25	22	10	65.0	14	34.0	22	...	...
	Bawtry (Hesley Hall)	1.07	— .27	.27	15	13	...	...	...	...	...	...
	Derby (Midland Railway)	1.67	+ .12	.49	14	16	65.0	19, 20	34.0	15	0	...	
VIII.	Bolton (The Park)	2.57	+ .38	.31	2	21	59.5	19	35.6	10	0	1	
IX.	Wetherby (Ribston Hall)	1.78	+ .04	.39	14	16	...	...	...	...	...	...
	Arncliffe Vicarage	7.63	+ 4.32	1.31	28	21	...	...	...	...	...	...
	Hull (Pearson Park)	1.15	— .44	.40	15	14	63.0	29, 30	34.0	12b	0	7	
X.	Newcastle (Town Moor)	1.59	— .07	.37	22	14	...	...	...	...	...	...
	Borrowdale (Seathwaite)	14.40	+ 8.06	2.60	2	21	63.5	19	33.6	1	0	...	
XI.	Cardiff (Ely)	2.28	+ .10	.35	2, 29	17	...	...	...	...	...	...
	Haverfordwest (High St.)	2.12	— .30	.41	13	14	63.7	19	33.7	11	0	3	
	Aberystwith (Gogerddan)	3.08	+ .51	.72	29	13	70.0	19	34.0	19	0	...	
	Llandudno	1.49	— .29	.18	2	17	62.0	12	38.8	9	0	...	
XII.	Cargen [Dumfries]	4.38	+ 2.05	.86	3	19	64.0	19	34.0	12	0	...	
XIII.	Edinburgh (Royal Observatory)	1.69	...	.30	9	17	62.5	19	32.6	10	0	5
XIV.	Colmonell	2.71	+ .54	.48	28	20	64.0	29	31.0	26	1	...	
XV.	Tighnabruach	6.67	...	.77	2	27	54.0	23	31.0	20	3	3
	Mull (Quinish)	6.17	+ 3.38	.89	5	27	...	...	...	...	...	...
XVI.	Loch Leven Sluices	4.23	+ 2.24	.60	3	16	...	...	...	...	...	...
	Dundee (Eastern Necropolis)	1.70	+ .16	.30	5, 13	18	63.6	18	33.6	9, 19	0	...	
XVII.	Braemar	2.78	+ .69	.70	2	18	56.3	19	23.3	1	5	23	
	Aberdeen (Cranford)	1.83	— .01	.51	13	16	61.0	29	30.0	3, 4	4	...	
	Cawdor (Budgate)	2.77	+ 1.20	.58	6	19	...	...	...	...	...	...
XVIII.	Glencarron Lodge	13.29	+ 8.63	1.30	27	27	...	...	...	...	...	...
	Bendamph.	12.15	+ 7.75	1.50	2	25	...	...	...	...	...	...
XIX.	Dunrobin Castle	5.25	+ 3.48	.80	27	19	60.0	19	30.0	4	1	...	
	Castletown	4.17	...	.76	5	25	63.0	19	31.0	8, 9	5	...
XX.	Killarney	3.23	— .53	.58	3	22	64.0	30	37.0	1	0	...	
	Waterford (Brook Lodge)	1.15	— 1.47	.21	17	14	61.5	19, 29	29.0	11	1	...	
	Broadford (Hurdlestown)	2.09	+ .01	.28	17	23	60.0	29	34.0	16c	0	...	
XXI.	Carlow (Browne's Hill)	1.54	— .75	.37	2	12	...	...	...	...	...	...
	Dublin (Fitz William Square)	1.12	— .85	.19	2	19	62.0	27	35.7	21	0	1	
XXII.	Ballinasloe	2.08	— .21	.29	2	23	67.0	19	29.0	19	3	...	
	Clifden (Kylemore House)	7.39	+ 2.12	1.00	13	25	...	...	...	...	...	...
XXIII.	Seaforde	2.49	+ .06	.25	2	23	60.0	18	32.0	18	1	3	
	Londonderry (Creggan Res.)	3.22	+ .76	.30	9	26	...	...	...	...	...	...
	Omagh (Edenfel)	3.07	+ .71	.60	5	24	60.0	19	32.0	9c	3	7	

+ Shows that the fall was above the average; — that it was below it. a and 18, 19, 20. b and 16, 20, 21. c and 17, 20.

SUPPLEMENTARY RAINFALL, APRIL, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·36	XI.	New Radnor, Ednol	2·13
„	Sheppey, Leysdown	·90	„	Rhayader, Nantgwilt ...	4·18
„	Hailsham	1·08	„	Lake Vyrnwy	4·22
„	Crowborough	1·43	„	Ruthin, Plás Drâw.....	1·14
„	Ryde, Beldornie Tower.....	1·03	„	Criccieth, Talarvor.....	2·52
„	Ensworth, Redlands.....	1·31	„	Anglesey, Lligwy	2·19
„	Alton, Ashdell	1·70	„	Douglas, Woodville	2·20
„	Newbury, Welford Park ...	1·35	XII.	Stoneykirk, Ardwell House	1·69
III.	Harrow Weald	·95	„	Dalry, Old Garroch	6·02
„	Oxford, Magdalen College..	·77	„	Langholm, Drove Road.....	5·74
„	Banbury, Bloxham.....	·89	„	Momaive, Maxwelton House	4·81
„	Pitsford, Sedgebrook	·88	„	Lilliesleaf, Riddell	2·36
„	Huntingdon, Brampton.....	·71	XIII.	N. Esk Reservoir [Penicuik]	4·30
„	Wisbech, Bank House	·52	XIV.	Maybole, Knockdon Farm..	3·54
IV.	Southend	·58	„	Glasgow, Queen's Park	4·39
„	Colchester, Lexden.....	·92	XV.	Inveraray, Newtown	9·69
„	Saffron Waldon, Newport...	·83	„	Ballachulish, Ardsheal	11·66
„	Rendlesham Hall	·99	„	Campbeltown, Redknowe...	3·62
„	Swaffham	1·12	„	Islay, Eallabus	5·29
„	Blakeney	·58	XVI.	Dollar	5·02
V.	Bishop's Cannings	1·52	„	Balquhilder, Stronvar	9·79
„	Ashburton, Druid House	2·21	„	Coupar Angus Station	2·27
„	Okehampton, Oaklands.....	2·62	„	Blair Atholl.....	4·01
„	Hartland Abbey.....	1·75	„	Montrose, Sunnyside.....	1·32
„	Lynmouth, Rock House	1·70	XVII.	Alford, Lynturk Manse	1·97
„	Probus, Lamellyn	1·32	„	Keith, H.R.S.	2·09
„	Wellington, The Avenue ..	1·21	XVIII.	Fearn, Lower Pitkerrie.....	2·33
„	North Cadbury Rectory ..	1·45	„	S. Uist, Askernish	5·58
VI.	Clifton, Pembroke Road ..	2·29	„	Invergarry	11·44
„	Moreton-in-Marsh, Longboro'	1·21	„	Aviemore, Alvie Manse.....	2·96
„	Ross, The Graig	1·25	„	Loch Ness, Drumadrochit.	4·15
„	Shifnal, Hatton Grange.....	1·35	XIX.	Invershin	4·44
„	Wem Rectory	·87	„	Altnaharra	6·67
„	Cheadle, The Heath House.	1·92	„	Bettyhill	5·03
„	Coventry, Kingswood	1·15	„	Watten, H.R.S.	3·19
VII.	Market Overton	1·28	XX.	Cork, Wellesley Terrace ...	1·28
„	Market Rasen	·99	„	Darrynane Abbey	3·23
„	Workshop, Hodsock Priory..	1·18	„	Glenam [Clonmel]	2·16
VIII.	Neston, Hinderton.....	·73	„	Ballingarry, Hazelfort	1·95
„	Southport, Hesketh Park...	1·69	„	Miltown Malbay.....	3·79
„	Chatburn, Middlewood	4·21	XXI.	Gorey, Courtown House	1·22
„	Duddon Valley, Seathwaite Vic.	6·02	„	Moynalty, Westland	1·88
IX.	Langsett Moor, Up. Midhope	3·68	„	Athlone, Twyford	2·17
„	Baldersby	1·56	„	Mullingar, Belvedere.....	2·19
„	Scalby, Silverdale	1·27	XXII.	Woodlawn	2·10
„	Ingleby Greenhow Vicarage	1·78	„	Westport, Murrisk Abbey..	4·24
„	Middleton, Mickleton	2·02	„	Crossmolina, Enniscoo	5·33
X.	Beltingham	2·88	„	Collooney, Markree Obsy...	3·49
„	Bamburgh.....	·78	XXIII.	Enniskillen, Portora	2·95
„	Keswick, The Bank	5·13	„	Warrenpoint	2·19
„	Mehnerby Rectory	2·63	„	Banbridge, Milltown	1·70
XI.	Llanfrechfa Grange.....	2·01	„	Belfast, Springfield	3·20
„	Treherbert, Tyn-y-waun ...	6·63	„	Bushmills, Dundarave	2·77
„	Llandoverly, Tonn	2·45	„	Stewartstown	2·65
„	Castle Malgwyn	2·56	„	Killybegs	3·41
„	Llandefaelog-fach	2·02	„	Horn Head	3·36

METEOROLOGICAL NOTES ON APRIL, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunder-storm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A month of beautiful weather, mild and sunny, with cool breezes but almost entire absence of harsh E. wind. The R was slight and the greater part fell during the night. No frost was registered in the screen, and the mean min. temp. was $43^{\circ}\cdot4$, or $3^{\circ}\cdot7$ above the average, and the highest in April during 47 years. The duration of sunshine was $141\cdot3^*$ hours and of R only $18\cdot9$ hours. Mean temp. $48^{\circ}\cdot1$, or $2^{\circ}\cdot4$ above the average.

TENTERDEN.—A beautiful spring month, generally dry, but very windy for the first 10 days. Duration of sunshine $177\ddagger$ hours.

HARTLEY WINTNEY.—Showery, with westerly winds for the first fortnight; then drier and harsher. Vegetation backward.

PITSFORD, SEDGEBROOK.—The first week was rather wet and squally, the remainder fine and warm. R $\cdot96$ in. below the average. Mean temp. $48^{\circ}\cdot5$.

BRUNDALL.—A magnificent April, warmer than any since 1894. On no day did the temp. fail to reach 50° , an occurrence which has not happened since observations commenced in 1883.

TORQUAY.—R $1\cdot28$ in. below the average. Duration of sunshine $180\cdot2^*$ hours, or equal to the average. Mean temp. $50^{\circ}\cdot2$, or $2^{\circ}\cdot0$ above the average. Mean amount of ozone $5\cdot8$.

WELLINGTON.—On the 15th set in one of the finest periods experienced for a considerable time, only $\cdot08$ in. of R falling on 16 days. Abundant sunshine.

NORTH CAUBURY RECTORY.—Seasonable, with small range of temp. R less than in any April in 8 years, and less than in any month since Sept., 1902.

CLIFTON.—The first fortnight was showery and cool, with rather strong westerly winds. Fine weather from 16th to 20th and from 23rd to 27th.

ROSS.—An almost typical April, with much less R than usual. The mean min. ($41^{\circ}\cdot8$) was the highest since 1865, but the max. ($57^{\circ}\cdot4$) was scarcely above the average. On no night was frost recorded in the screen, and as a consequence vegetation, though somewhat backward, progressed rapidly.

BOLTON.—Typical April weather, showers and sunshine being sandwiched together throughout. The shade min. ($35^{\circ}\cdot6$) was the highest on record, and the daily range ($10^{\circ}\cdot7$) the least in 18 years. Mean temp. $45^{\circ}\cdot5$, or $1^{\circ}\cdot2$ above the average. Duration of sunshine $102\cdot7^*$ hours, or 8 hours below the average.

SOUTHPORT.—Exceptionally stormy, W.S.W. winds greatly preponderating. Mean temp. $1^{\circ}\cdot3$ above the average. Duration of sunshine 7^* hours below the average, and R $\cdot03$ in. below the average. Mean daily movement of the wind 135 miles above the average.

UPPER MIDHOPE.—Stormy from 1st to 10th, with sleet, S, H and R. Fine from 16th to 30th. R $\cdot82$ in. above the average of 9 years.

HULL.—On the whole genial spring weather prevailed. After the 7th it was generally mild, with a fair amount of bright sunshine.

LLANFRECHFA GRANGE.—Cold winds and warm sun in the latter part; favourable for garden and field work.

HAVERFORDWEST.—Strong westerly winds and gales throughout. No extremes of temp., which was uniformly below the average, especially the max.; this exercised a salutary influence in checking blossom of fruit trees and vegetation generally. Duration of sunshine $147\cdot6^*$ hours.

DOUGLAS.—The gale of March 31st continued without intermission until April 11th. Temp. about normal, with low maxima. The light R and constant wind were favourable to agriculture.

* Campbell-Stokes.

† Jordan.

SCOTLAND.

MAXWELTON HOUSE.—The first half was wet and cold, the second fine and warm with much sunshine. Mean temp. $46^{\circ}0$, or $1^{\circ}0$ above the average. R 2.04 in. above the average.

LILLIESLEAF, RIDDELL.—Very windy throughout, and cold up to the last few days. Vegetation was backward, but seeds well got in.

BALLACHULISH.—R 7.25 in. above the average and the greatest recorded here.

MULL, QUINISH.—The wettest April since the gauge was started in 1874.

LYNTURK MANSE.—Frequent strong winds throughout. Notwithstanding a large number of rainy days, there was a good sowing time.

DRUMNADROCHIT.—The greatest R in April for 19 years, and 2.38 in. above the average. The rainy days were also the greatest on record.

BETTYHILL.—Heavy R, generally accompanied by strong winds.

CASTLETOWN.—The first half was cold, windy and wet, with S on 9th. From 15th to 21st was very mild and dry, and from 21st to the end wet, stormy and cold.

IRELAND.

CORK.—R 1.60 in. less than the average. Mean temp. $3^{\circ}5$ below the average.

DARRYNANE ABBEY.—Changeable, with strong northerly wind. R 13 per cent. below the average. Vegetation very backward.

WATERFORD.—R less than half the average. A very late spring.

MILTOWN MALBAY.—The stormiest and coldest April remembered. Only four days without R.

DUBLIN.—Favourable though changeable. The first few days were stormy and cold, but after the 9th only .29 in. of R fell. Mean temp. $49^{\circ}1$ and duration of sunshine 175.5 hours, both above the average. R was frequent, but moderate in amount.

OMAGH, EDENFEL.—Harsh and unsettled, except for a short spell in the middle. The weather was such as might be expected from the frequent fluctuating pressure. Although robust vegetation did not suffer much, delicate garden seeds made little progress.

THE FOUR MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—April, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	7.64	124	Arncliffe	25.13	128	Braemar	9.22	94
Tenterden	9.34	131	Hull	6.61	100	Aberdeen	11.16	122
Hartley Wintney	9.35	138	Newcastle.....	7.33	107	Cawdor	7.30	92
Hitchin	7.18	117	Seathwaite	52.94	121	Glencarron	31.35	107
Winslow	8.41	135	Cardiff	16.59	148	Dunrobin	11.74	127
Westley	6.95	109	Haverfordwest	16.22	124	Killarney	21.04	125
Brundall.....	7.47	118	Gogerddan	14.58	114	Waterford	16.12	139
Alderbury	11.46	143	Llandudno	9.28	113	Broadford	13.39	139
Ashburton	24.19	146	Dumfries	14.77	108	Carlow	11.59	115
Polapit Tamar	17.91	173	Lilliesleaf	10.63	124	Dublin	9.06	115
Stroud	10.97	143	Colmonell	13.91	102	Mullingar.....	14.25	137
Woolstaston	10.42	128	Glasgow	12.28	117	Ballinasloe	14.16	134
Boston	6.09	115	Inveraray	26.43	113	Clifden	31.12	128
Hesley Hall	7.31	131	Islay	18.26	131	Crossmolina	23.14	140
Derby.....	8.09	134	Mull	22.72	129	Seaforde	12.29	111
Bolton	12.40	119	Loch Leven	11.99	113	Londonderry..	13.34	116
Wetherby	9.52	147	Dundee	9.55	117	Omagh	16.10	146

NOTE.—In the above Table the first column gives the total rainfall of the four months, not, as in former years, the difference from the average.

Climatological Table for the British Empire, November, 1903.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.			Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.		
	Temp.	Date.	Temp.	Date.										
London, Camden Square	57·2	1	29·9	20	50·2	39·7	41·3	88	82·3	23·3	1·86	12	6·3	
Malta.....	75·3	18	48·5	14	66·9	55·4	54·9	86	119·1	43·4	3·38	14	4·6	
Lagos, W. Africa	91·0	22	70·0	10	87·4	75·1	75·2	75	146·0	68·0	4·11	7	4·9	
<i>Cape Town</i>	86·0	9	46·1	16	70·2	53·3	51·1	68	...	...	·25	4	4·6
<i>Durban, Natal</i>	87·6	19	52·4	4	78·6	63·2	...	...	146·1	...	8·99	19	6·7
<i>Mauritius</i>	88·4	27a	60·1	23	82·7	65·1	61·5	66	152·3	54·5	·96	8	4·9	
Calcutta.....	84·4	3	57·9	30	81·3	64·8	63·2	71	145·0	52·1	·02	1	3·2	
Bombay.....	90·5	11	68·3	27	86·3	72·3	69·0	72	137·5	58·2	·00	0	1·5	
Madras	89·8	1	66·0	25	82·9	72·2	71·2	85	141·3	60·5	17·76	13	6·3	
Kodaikanal	69·8	23	45·7	21	62·3	50·1	47·0	76	132·8	34·3	5·85	12	5·7	
Colombo, Ceylon... ..	90·7	13	70·5	27	88·5	74·6	72·4	78	155·0	65·5	·94	12	4·9	
Hongkong.....	85·3	18	46·7	28	73·8	62·1	53·6	62	133·3	...	1·09	3	4·0	
<i>Melbourne</i>	93·9	25	41·9	13	72·2	53·6	51·3	68	156·1	34·0	4·28	10	6·2	
<i>Adelaide</i>	96·2	25	46·3	13	80·2	58·5	49·8	49	149·7	40·4	2·57	12	4·6	
<i>Coolgardie</i>	99·0	24	46·0	15b	82·7	55·6	47·6	47	162·6	43·1	·15	4	3·0	
<i>Sydney</i>	95·1	26	51·4	21	71·6	58·9	37·0	68	132·3	44·2	1·96	13	6·2	
<i>Wellington</i>	79·5	30	38·2	21	67·3	51·3	51·4	76	136·0	30·0	5·41	12	6·4	
<i>Auckland</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Negril Point.	89·2	7	61·0	30	85·4	71·1	70·3	77	...	...	2·46	9	...
Trinidad	91·0	Var	67·0	21	77·2	73·0	71·0	72	177·0	64·0	2·59	5	...	
Grenada.....	83·6	28	72·2	1	85·5	74·9	72·6	77	152·0	...	2·53	13	2·5	
Toronto	70·2	3	6·1	26	42·2	27·8	27·2	76	86·0	2·4	1·26	14	6·1	
Fredericton	60·7	4	3·1	27	39·9	22·9	22·2	67	...	...	4·86	13	5·8
Winnipeg	71·3	2	—28·7	25	29·1	8·4	...	...	...	...	1·50	5	4·8
Victoria, B.C.	59·0	1	31·2	17	47·9	41·1	...	...	...	...	6·00	...	8·8
Dawson	40·5	4	—42·4	16	2·7	—10·3	...	...	...	...	·45	4	3·8

a and 30. b and 16.

MALTA.—Mean temp. of air 2°·6 below, dew point 0°·5 above, and R ·24 in. below, and mean hourly velocity of wind 0·8 miles above averages. Mean temp. of sea 67°·2.

Natal.—R 3·99 in. above 30 years' average.

Mauritius.—Mean temp. of air 1°·5, dew point 2°·4, and R ·90 in. below, averages. Mean hourly velocity of wind 10·4 miles, or 0·1 mile below average; extremes 23·5 on 15th, and 2·0 on 28th; mean direction E. by S.

MADRAS.—Bright sunshine 122·6 hours, or 35·6 per cent. of the possible amount.

KODAIKANAL.—Mean temp. of air 55°·0. Mean velocity of wind 237 miles per day. Bright sunshine 143·6 hours.

COLOMBO, CEYLON.—Mean temp. of air 81°·0 or 1°·2 above, of dew point 0°·1, and R 12·06 in., below averages. Mean hourly velocity of wind 8·2 miles, prevailing dir. S. W.

HONGKONG.—Mean temp. of air 67°·2, or 2°·0 below average. Bright sunshine 209·2 hours. Mean hourly velocity of wind 9·6 miles; prevailing direction N. E.

Adelaide.—Mean temp. of air 2°·1, and R 1·59 in., above averages.

Sydney.—Mean temp. of air 1°·6, humidity 1·0, and R 1·19 in., below averages.

Wellington.—Mean temp. of air 5°·1, and R 2·45 in., above averages.

TRINIDAD.—R 4·69 in. below the 40 years' average.

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Correspondence.

To the Editor of Symons's Meteorological Magazine.

A THREE YEARS' PERIOD IN RAINFALL.

I HAVE stumbled on a period in my own rainfall figures which may be only a coincidence, but it is so regular that I should like to know whether it would hold good for other parts. The period is a three year one, and goes back for the whole time of my observations, *viz.*, 24 years.

I. 1879...No record	1882...57·53	1885...49·81	1888...51·64
Very wet			
II. 1880...45·09	1883...48·60	1886...48·16	1889...40·59
III. 1881...48·04	1884...41·11	1887...30·44	1890... 48·18
I. 1891...54·41	1894...51·16	1897...52·06	1900...53·84
II. 1892...37·43	1895...46·97	1898...38·41	1901...39·11
III. 1893...37·36	1896...37·77	1899...41·08	1902...39·72
I. 1903...58·76		I. 53·65	
II. 1904... —	Means...	II. 43·04	
III. 1905... —		III. 40·46	

How I came upon this is interesting, though this too may be a coincidence. In accordance with my usual custom if I hear of any periodic terrestrial or cosmic phenomena, I try to see if I can find any relation to meteorological records. Thus, in *Nature* of the 17th ult., I found a report of a six years' period for the polar motion, the latest maximum deviations occurring in 1891 and 1897, whilst the minima were in 1894 and 1900. On referring to my table it will be seen that all these years are those of maximum rainfall, the rainfall period being thus half the length of the polar period.

I note that the sequence appears to begin in 1879, and in this connection the figures for Truro since 1850, which I have been examining since writing the above, may be of interest. They seem, in one way, to destroy the validity of the three years' period, and yet this is scarcely so, as may be seen from the rainfall chart issued by the Royal Institution of Cornwall. It shows that 1852 is a year

of maximum rainfall; 1855 is a year of minimum, which is the beginning of severe recurrences of minima in three years; then we have two periods not well marked, followed by seven (now eight) recurrences of maximum rainfall in three years. It looks rather, if such a thing were possible, as if there is something causing a reversal, and the period from 1874 to 1880 gives the appearance of being a transition period and under the influence of two opposing forces or conditions. It will be noticed, too, that from 1852 to 1877 is 25 years, and if this is the length of the cycle we should now be near another time of reversal. The year 1852, just before the change it may also be noticed, was a year of exceptional rainfall something like last year (1903). Again, the average yearly rainfall from 1855 to 1872, inclusive, is about three inches more than that for the years 1882 to 1902 inclusive.

Thus, in this neighbourhood, there has been, with two exceptions, a three years' period certainly from 1852 onward, but at about the middle of this period there was a reversal. This reversal idea may look like special pleading, but the regularity of the sequence in the two periods is certainly striking. The reversal peculiarity, too, would tend to mask the three year period if the observations ran over a long series of years.

ARTHUR P. JENKIN.

Trewirgie, Redruth, April, 1904.

[Mr. Jenkin has hit upon a very interesting recurrence which we have often noticed and frequently referred to as an example of an undoubted cycle springing up suddenly and therefore not to be depended on for the future. There is no doubt as to the recurrence of one wet and two less wet years in all parts of the British Isles during the last fifteen or sixteen years. Some stations do not show the relation clearly, but the general average of the whole country does so from 1891 onwards, as is shown in the Table on p. [154] of *British Rainfall, 1902*. The figures as percentage differences from the mean may be grouped as follows:—

1891 + 5	1894 + 5	1897 + 2	1900 + 11	} Mean {	I. + 6
1892 - 6	1895 - 8	1898 - 5	1901 - 10		II. - 7
1893 - 15	1896 - 7	1899 - 2	1902 - 15		III. - 10

The earlier years given in the Table just cited show no relation to the Cornish record or to the three-years' cycle, except in the means. They are:—

1882 + 22	1885 - 3	1888 - 6	} Mean {	I. + 4
1883 + 8	1886 + 7	1889 - 8		II. + 2
1884 - 11	1887 - 28	1890 - 4		III. - 14

The subject is one of the many which we hope to investigate fully when time can be found. With reference to this repetition of one wet and two dry years, we wrote in *The Times* of 18th November, 1903, in the course of a controversy on Meteorological Cycles, as follows:—

"I could mention some curious and quite empirical recurrences of short period which have held good for the British Isles as a whole for many cycles, but which did not hold before a given date, and consequently cannot be expected to continue throughout the future. Should they hold good once more, 1904 and 1905 will prove dry."

There is some indication that Mr. Jenkin's suggestion of a reversal of the order of wet and dry years might carry a three years' cycle further back. It may be that in dry spells like 1891—1902 the order of one wet and two dry years holds, and in wet spells the order of one dry year and two wet. In the meantime, we shall gladly receive the opinions of our readers, and in the future we may discuss the problem in all its bearings.—ED. *S.M.M.*]

A DANGER IN "SMOOTHING" RAINFALL VALUES.

DEALING with 73 years of monthly rainfall at York (1831—1903), I had first smoothed to three-yearly means, before testing for any possible association with Wolfer's eleven-year sun-spot cycles, by taking the average of the $6\frac{1}{2}$ cycles for each year, I. to XI., of the smoothed cycle, where I. is the year of minimum sun-spots and VI. of maximum. The examination dealt specially with the three autumn months, August to October. The method was fully justified when considering the cycle as a whole.

On re-working the results without first smoothing, however, I found that a striking peculiarity had been entirely obscured: namely, a sudden rise from the second to the third year of the cycle. In August and October this gives the highest point of the curve. This is the more striking in October as the minimum is in the previous year (II.) The same is the case for the whole year, based on 87 years in all, or nearly eight cycles. The actual means are: for October, 1.5 inches in II., 3.6 inches in III.; for the year, 23.0 inches in II., 27.7 inches in III. Thus III. compares with II. as 240 and 120 to 100, respectively. The means are 2.59 and 24.73 inches.

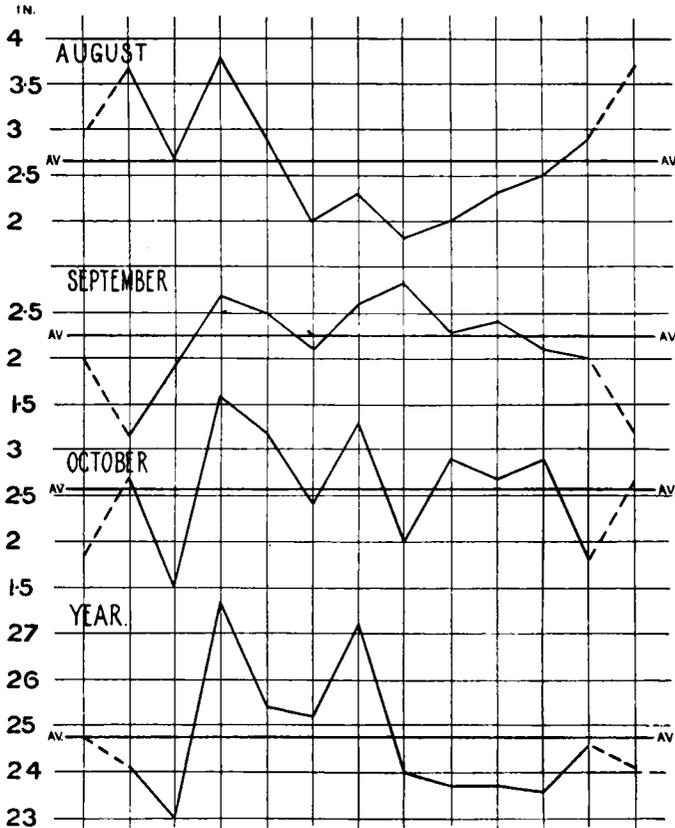
When the smoothed figures were used, the annual maximum was transferred to IV. and V. and the minimum to IX. As stated above, this, for general results, is important. It is instructive that we get a continuous, very regular curve, from 23.7 in. to 25.9 in.

In 1902 the York year's rainfall was 18.69 in. In 1903 it rose to 30.31 in. It is significant that these are, presumably, the years II. and III. of the current sun-spot cycle (*i.e.*, if the period from minimum to maximum proves normal).

Taking all 12 months and the whole year, the following further facts are of interest:—

(a). Six of the thirteen show an apex in the curve at III.; in three others there is a considerable rise, but continued to IV. January, June and November are neutral. February gives the minimum in III.

	MIN.	II	III	IV	V	MAX.	VII	VIII	IX	X	XI	MEANS.
AUG.	37	27	38	29	20	23	18	20	23	25	29	2.68 (70 Years)
SEPT.	12	19	27	25	21	26	28	23	24	21	20	2.26 (,, ,,)
OCT.	27	15	36	32	24	33	20	29	27	29	18	2.59 (,, ,,)
YEAR.	24	123	0277	254	252272	24	0237	237	236246			24.73 (84 ,,)



CURVES OF RELATION OF SUNSPOTS TO RAINFALL.

(b.) Twenty of the twenty-six maxima and minima fall either on I. and VI. or on the two years following. Chance distribution would make us expect fourteen only.

(c.) No maximum or minimum occurs in XI. ; only one in V.

(d.) In nearly every case of a marked break in the regularity of the curves this occurs in III.

(e.) Lockyer's curves from Tacchini's solar prominence values show precisely similar sudden rises from a minimum to a maximum in 1881 and 1892.

The object of the present note is that other records may be considered in the same way. The long series from Padua shows very similar peculiarities, though these are rather less marked when only the last seventy years are considered.

J. EDMUND CLARK.

CLOUD OBSERVATIONS AND UPPER ATMOSPHERIC CURRENTS.

AETER numerous observations I have noticed repeatedly how thin rolled stratus bands, if watched for some time, will gradually break up into cirro-cumulus cloudlets of varying size ; also, the large drifts of stratified cumulus will break up into alto-cumulus drifts. It would appear that warmer currents with an ascensional movement are setting in, in the upper atmosphere, to produce these disintegrations, and unsettled weather may as a rule be looked for to follow. These cloud formations and their gradual change were visible to the best advantage on January 17th last. The wind blew from the W. with the force of a light breeze and cloud movement was from the N.W. At 4 p.m. the sky from the W. to zenith was covered with thin roll stratus in the form of narrow pleats, which by 4.30 p.m. had completely broken up, giving place to a pallium of cirro-cumulus. At 9 a.m. on the same day the same changes were visible but on a larger scale, the thin roll stratus being replaced by strato-cumulus and the cirro-cumulus by alto cumulus. Another peculiarity I have noticed is the relation of the wind, when blowing in eddies at the earth's surface, to the cloud formation above. To take an example : on February 4th last, at 5.30 p.m., after a fine day with a light S.W. breeze, straight tapering bands of cirro-macula and alto-stratus were visible in the S.W., parallel to the S.W. horizon ; by 6 p.m. the wind, though variable in force at times, reached the force of a moderate breeze from the W. to S.W., coming in eddies with a whirling movement ; the bands of cirro-macula and alto-stratus by this time had the appearance of being swept backwards and forwards and twisted up, as though under the influence of irregular currents with a whirling movement as were prevalent at the Earth's surface.

Lately specially strong currents appear to have been at work in the upper atmosphere when a light breeze has been blowing at the surface of the ground. On March 22nd last, during the evening, cumulo-nimbus was very prevalent with fair intervals. Cloud movement was from the N.W., the estimated motion being 2 ; when the cloud-bank had passed over zenith and was in the S.E. quarter, the bank had the peculiar appearance of being heaped upwards with a swept-up appearance, as though under the influence of strong currents with a sweeping upward movement.

On March 28th air currents were most diversified in force ; at a height of 6 ft. from the ground in an open situation the wind blew with the force of a gentle breeze from the S.S.W. ; higher up, at about 40 ft., among an avenue of elm trees, the wind reached the force of a strong breeze, their top branches swaying most rapidly ; and lower down, though equally exposed, the movement was nil. A moderate gale sprang up from the S.W. towards 10 p.m. on the above date.

Sutton, Surrey.

S. C. RUSSELL.

HISTORY OF THE DAUBENY LABORATORY.

IN your recent review of "A History of the Daubeny Laboratory, Magdalen College, Oxford" (*Met. Mag.*, p. 73), the figures given for the average rainfall for the months of October, November and December, as well as for the averages for the year, are given correctly, but in certain copies of the book, which were sent out before the corrections were made, they have been wrongly stated. I am much obliged to you for having drawn my attention to an important clerical error.

R. T. GÜNTHER.

Magdalen College, Oxford, May 23rd, 1904.

HEAVY RAIN OF MAY 27th.

ON Friday morning the rainfall registered $\cdot33$ of an inch, from 10.15 to 12.25 $\cdot75$ of an inch fell, at 7.30 p.m. 1.69 inches had fallen, and at 9 a.m. on Saturday morning there was $\cdot04$ of an inch, giving a total of 2.48 inches for the 24 hours. Very heavy thunder and lightning occurred about 12 o'clock overhead. This is a record for this station, being the highest ever registered for the previous 24 hours for the 10 years during which observations have been taken.

WILLIAM HALL.

Swerford, Oxford, 30th May, 1904.

ROYAL METEOROLOGICAL SOCIETY.

THE first of the Afternoon Meetings for the present session was held on Wednesday, May 18th, in the Society's Rooms, 70, Victoria-street, Westminster, Captain D. Wilson-Barker, President, in the chair. Mr. W. M. Edwards, Mr. E. G. Fenning, Mr. K. H. M. Finch, Mr. R. G. Kirkby, and Mr. L. G. H. Lee were elected Fellows of the Society.

Previous to the discussion on Mr. W. L. Dallas's paper on "The Variation of the Population of India compared with the Variation of Rainfall in the decennium 1891-1901," which had been postponed from the last meeting, Dr. H. R. Mill gave a brief summary of the contents of the paper. [See this *Magazine*, vol. 39, p. 71.]

Dr. A. Buchan, F.R.S., and Mr. Baldwin Latham showed that Plague was influenced to a great extent by meteorological conditions, and that it followed the tensional difference between the temperature of the soil at a depth of 5 feet and the tensional difference due to the temperature of the dew point of the air, or that it arose from exhalations from a polluted and pest-sown soil.

Dr. H. R. Mill said that the paper had a special interest for him on account of the way in which it sought for a connection between

varying meteorological conditions and vital statistics. The problem was one of great geographical interest, and he believed that the relations pointed out by the author were not likely to be set aside. Dr. Mill then criticized Mr. Dallas's method of obtaining the mean rainfall for the various provinces, and said that it seemed to him that the only possible way of comparing the fluctuations of rainfall in such a case was by reducing all the values to percentages and allowing for the area of the division, or by weighting the means in proportion to the areas to which they referred so as to yield figures representative of the actual volume of precipitation.

The Hon. F. A. Rollo Russell read a paper on "The Principal Causes of Rain." He stated that the chief causes of rain are only four, but several of these are often in co-operation. These causes might be briefly described as follows:—(1.) The forced ascent of moist air by the slopes of mountains. (2.) A mass of air invading rather suddenly another mass moving from an opposite direction and maintaining its flow below the opposing current which it displaces. (3.) The ascent of more or less moist air through heavier and colder air to a height where condensation of vapour takes place, increased radiation of heat towards space, and often electrical developments producing further condensation, increase of temperature and renewed ascent with the same results. (4.) The mixture of currents of air from different directions.

A brief discussion followed, in which the President, Mr. D. W. Horner, Mr. H. Southall, and Mr. F. Gaster took part, and Mr. Russell replied.

Mr. W. C. Nash read a paper on "The Observations of Rainfall at the Royal Observatory, Greenwich, in the years 1815 to 1903." The author has made a critical inquiry into the circumstances relating to the early history of the Greenwich register, and has drawn up an authoritative table of monthly rainfall for the long period of 89 years. The average annual rainfall is 24·36 in., and the number of rainy days 157. The greatest annual fall was 35·54 in. in 1903, and the least 16·38 in. in 1864. During the five months January to May no monthly fall exceeding 4·37 in. was recorded; but in the remaining seven months there were 24 falls exceeding 5 inches, distributed in the following proportion:—June 3, July 8, August 2, September 1, October 6, November 2, and December 2. Light falls of rain are spread principally through the nine months January to September, with a decided preponderance in spring. Of falls to a less amount than 0·3 in. per month, 5 have been recorded in the month of April, 4 in February, 3 each in March, May and July, 2 in January, June and September, and 1 in August.

An interesting discussion ensued, which was taken part in by the President, Mr. W. Marriott, Mr. W. Ellis, F.R.S., Mr. F. J. Brodie, Mr. C. Harding, Dr. H. R. Mill, and Dr. H. N. Dickson, and Mr. W. C. Nash replied.

ROYAL OBSERVATORY, GREENWICH.

THE Annual Visitation of the Royal Observatory took place on Saturday, June 4th. A large number of scientific men were, as usual, invited to visit the Observatory, the various buildings of which were open for inspection, and as the day was fine, the visit was enjoyable.

The Board of Visitors—which consists of six representatives from the Royal Society, and six from the Royal Astronomical Society, as well as the Savilian Professor of Astronomy at Oxford, the Plumian Professor of Astronomy at Cambridge, and the Hydrographer of the Navy—met in the Octagon Room at 3 o'clock to receive the Report of the Astronomer Royal, Mr. W. H. M. Christie, F.R.S., on the work of the Observatory during the year ending May 10th, 1904. The Report dealt mostly with astronomical matters, but the following extracts will be of interest to meteorological readers:—

The solar activity has increased considerably during the year ending May 10, the Sun being free from spots on only 25 days, as against 100 in the previous year. The mean daily spotted area for 1903 is nearly six times as great as for 1902; still, as yet, the rate of increase is not so great as in the corresponding periods of the two preceding cycles. The greatest outburst of the year commenced on October 5, 1903, with the appearance at the east limb of the Sun of a group of spots much larger than any seen since September, 1898. Several fine groups have appeared since, particularly those first seen on October 25, October 30, November 5, November 30, 1903, and April 21, 1904.

The mean magnetic declination for 1903 was $16^{\circ} 19'$ West, and the mean dip $67^{\circ} 0' 51''$.

The mean temperature for the year 1903 was $50^{\circ} \cdot 2$, or $0^{\circ} \cdot 7$ above the average for the 50 years 1841–90.

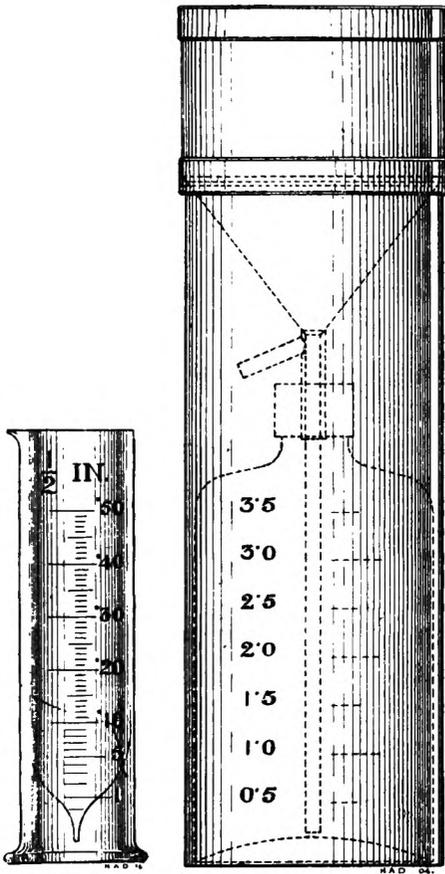
The rainfall during 1903 was 35·54 in., the heaviest ever recorded at Greenwich during one calendar year. The summer months in particular were very wet, more than 16 inches being recorded in June, July and August—viz., 6·07 in. in June, 5·27 in. in July, and 4·82 in. in August. The greatest fall registered at Greenwich in a single day for many years past—viz., 2·46 in.—occurred on July 23. In 1904, January and February were wet months, so that the total fall from March 1, 1903, to February 29, 1904, was over 37 inches.

A Fineman nephoscope has been provided for cloud observations in connection with the international balloon ascents.

Mr. W. Carpenter Nash retired on December 31, after a long and honourable connection with the Observatory of nearly 48 years, having been for the last 10 years Superintendent of the Magnetic and Meteorological Branch. He has been succeeded by Mr. W. W. Bryant.



A NEW PATTERN OF RAIN GAUGE.



MESSRS. LANDER & SMITH, of Canterbury, have recently brought out a new pattern of rain gauge which contains some interesting features. The standard pattern of Snowdon rain gauge is not likely to be displaced where durability and good workmanship outweigh the necessarily somewhat high price; and it undoubtedly ought to continue to be the standard. Still, Messrs. Lander & Smith have produced a rain gauge which is accurate and cheap, and appears likely to last well with careful handling. The material is japanned zinc and the chief novelty is that the receiving vessel is a glass bottle permanently fixed to the funnel, the tube of which passes through a cemented cork and reaches almost to the bottom. A second short tube, like the spout of a soda-water syphon, permits of the contents of the bottle being emptied for measurement

into the ordinary glass, which we are glad to notice is conical below and has a mark to indicate $\cdot 005$ in., the quantity which determines whether or no a day is to be classed as rainy. The bottle itself is graduated in half inches of rain, a precaution which we commend as it is a valuable check on the graduated glass, making it practically impossible to mistake the number of half-inches which fall during heavy rain.

Some observers will doubtless be inclined to try the new gauge, though many will greatly prefer the old and tried pattern. We welcome, in the new instrument, the indication it affords of living interest in the subject of rainfall measurement, and of a desire to supply instruments of good quality at a moderate price. In such circumstances competition is wholesome and deserves encouragement.

THE FIVE MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—May, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	9·60	124	Arnccliffe	29·66	129	Braemar	11·34	95
Tenterden	11·38	128	Hull	8·73	103	Aberdeen	14·02	125
Hartley Wintney	12·22	141	Newcastle.....	10·17	118	Cawdor	9·52	95
Hitchin .....	...	...	Seathwaite	62·60	119	Glencarron	37·09	107
Winslow	10·59	133	Cardiff	19·63	145	Dunrobin	13·24	119
Westley	9·09	110	Haverfordwest	19·15	124	Killarney	24·15	122
Brundall	9·27	114	Gogerddan	18·03	118	Waterford	18·54	130
Alderbury	14·32	147	Llandudno	11·13	111	Broadford	16·39	138
Ashburton	27·11	143	Dumfries	17·25	106	Carlow	14·59	117
Polapit Tamar	20·88	166	Lilliesleaf	13·56	129	Dublin	11·75	120
Stroud	12·83	134	Colmouell	16·19	100	Mullingar	16·77	129
Woolstaston	12·69	122	Glasgow	15·64	121	Ballinasloe	16·96	130
Boston	7·41	109	Inveraray	30·50	112	Clifden	35·56	123
Hesley Hall	9·05	127	Islay	21·23	131	Crossmolina	26·96	138
Derby	9·90	126	Mull	26·56	128	Seaforde	15·37	115
Bolton	15·33	117	Loch Leven	15·24	118	Londonderry..	15·99	113
Wetherby	12·86	158	Dundee	12·05	121	Omagh	18·49	136

NOTE.—In the above Table the first column gives the total rainfall of the five months, not, as in former years, the difference from the average.

SOUTH AFRICAN RAINFALL.

AN important paper on the Study of South African Rainfall was presented to the South African Philosophical Society in Cape Town, on December 29th, 1903, by Mr. J. R. Sutton. It gives a history of Kimberley rainfall from 1877 to 1902, and discusses the annual, monthly, daily and hourly quantities, both statistically and by means of harmonic analysis. The following notes are from an abstract of the paper in which quantities are expressed in vulgar fractions, as the limit of accuracy is evidently intended to be only to the nearest quarter inch it would be misleading to translate these into decimals, so that we must apologize for introducing this rather clumsy notation in our pages.

Mr. Sutton gives the heaviest annual fall at Kimberley as $31\frac{1}{4}$ inches in 1891, the least as $8\frac{3}{4}$ inches in 1897. This range he points out is less than that of similarly-situated places in Australia and India but greater than in South America. In Great Britain it is usual to find the wettest year with about twice the rainfall of the driest; in Kimberley we see that in a record of only 26 years' duration the wettest year had four times as much rain as the driest. The greatest daily fall was more than $4\frac{1}{2}$ inches, and we suppose that this means less than five inches. The last week of February

was the wettest, and the first week of August the driest time of the year.

The hourly variation of rainfall gave a curve which is nearly the inverse of the barometric oscillation and is closely connected with the dew-point curve. Rather more rain fell at night than during the day, but the rate of fall was greater in the day time. The relation of wind to monthly rainfall was found to be that the amount of rain decreased when the wind varied from its normal direction for the month.

A comparison was made between Kimberley and other places in South Africa, the wettest cited being Maclear's Beacon on Table Mountain with 87 inches, the driest Port Nolloth with only $2\frac{1}{2}$ inches in the year.

The author's conclusion is that the rain of central South Africa originates in the main in the Doldrums, being reinforced more or less by the moisture evaporated from the Indian Ocean; and that the aridity of the west coast is not caused, as Dr. Buchan believes, by the southern anticyclonic belt, but simply by the coldness of the water. The passage as to the Doldrums is somewhat obscure; possibly it may be a slip for the Calms of Capricorn; but the full paper will of course make the matter clear.

REVIEWS.

The Climate of Australasia in reference to its control by the Southern Ocean, by Professor J. W. GREGORY, D.Sc., F.R.S. Melbourne, Whitcombe and Tombs, Ltd. Size $7\frac{1}{2} \times 5$. Pp. 96.

THE versatile professor of geology, whose appointment to the University of Glasgow we rejoice to see, while holding a similar chair in the University of Melbourne, delivered a presidential address to the Dunedin meeting of the Australasian Association for the Advancement of Science on January 11th, 1904, upon the climate of Australasia, which he has now expanded into a plump pamphlet. Professor Gregory accepts as proved the existence of weather cycles, precise and recognisable enough to furnish a sure basis for long period weather forecasts, basing his opinions largely on the experience of the Indian meteorological service. We fear, however, that he does not make adequate allowance for the difference between the climatic conditions of the tropical and the temperate zones when he attempts to apply to southern and temperate Australasia deductions from observations made in tropical India. We are glad to see that Professor Gregory holds that long period forecasts will continue impossible until meteorology has advanced another stage, and we sympathise with his hope that the publication of this pamphlet will do something to help forward the proposals for the establishment of a united meteorological service for Australasia.

We are sure that it is wholly good that men who pursue one branch of physical science should occasionally look over the field of their neighbours, and bring to other specialists the advantage of a fresh eye and the suggestions of a mind untrammelled by the inevitable precautions and hesitations which impede the specialist in reaching a little beyond the facts with which he deals daily. Professor Gregory has read widely, and supports his arguments with numerous references to original sources of information, and his pamphlet is bound to be of service to all who read it. So far as Australasian meteorology is concerned, we may rest assured that the Antarctic expeditions now returned or returning to Europe will bring an immense addition to our knowledge of the Southern Ocean, which will provide meteorologists in the temperate parts of the southern hemisphere with very valuable material.

Nedböringttagelser i Norge. Udgivet af det Norske Meteorologiske Institut. Aargang IX. [Rainfall Observations in Norway. Published by the Norwegian Meteorological Institute. Ninth year.] 1903. Size $15\frac{1}{2} \times 11\frac{1}{2}$. Pp. xviii. + 126. Christiania, 1904. Price 6 kr.

WE have again to congratulate Professor Mohn on being first in the field with his account of Norwegian Rainfall for 1903. We know of no other official meteorological institution which is so prompt in publishing its annual volume, and our object in singling this out from the mass of annual reports for one, two or three years ago which we have received during the last few months, is to hold it up as an example which larger and richer nations than Norway would do well to follow.

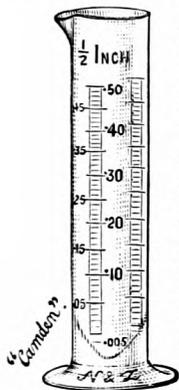
U.S. Department of Agriculture. Weather Bureau Bulletin L. Climatology of California. Prepared by ALEXANDER G. MCADIE, Professor of Meteorology. Washington, 1903. Size 12×9 . Pp. 270. Plates, &c.

DIFFERENT sections of this memoir are treated by different authors, and the general results are pointed out by Professor McAdie, though less fully than we should like to see. We are glad to notice that attention is paid to the distribution of climate in typical months of different character. While we are far from considering the determination and use of averages as valueless in climatological discussions, we feel strongly that they should be reinforced by a discussion of typical normal and extreme years, months, and even days. The volume before us is well illustrated by maps and diagrams, and it contains a selection of Professor McAdie's own fine photographs of clouds—or fog—from Mount Tamalpais.



METEOROLOGICAL NEWS AND NOTES.

THE "CAMDEN" RAIN GLASS has been designed by Messrs. Negretti and Zambra in order to include all the improvements suggested by recent correspondents in this Magazine. The scale is more clearly marked, the half-tenths being indicated on the left hand side, an undoubted improvement, while the lower part is conical so as to



enable the first hundredth to be distinctly subdivided. This removes the decision as to whether the amount is sufficient to justify it to be entered as nearer '01 than '00, and so to give a nominal "rainy day," from the region of guessing. This is a very important feature, for it compels the maker to calibrate the first two divisions, and thus overcomes the most fruitful cause of variation in the number of rainy days assigned to a station. A third addition is a duplicate scale on the back, which is liked by some observers, though we confess we can obtain accurate readings without its aid: still it can do no harm. The new glass is necessarily a little more expensive than the usual pattern.

THE BEN NEVIS OBSERVATORIES have been the subject of an interchange of correspondence in the Scottish press in connection with statements made by Lord McLaren at the recent meeting of the Scottish Meteorological Society. Lord McLaren stated that the Meteorological Office had "never made the slightest use of the observations furnished to them" from Ben Nevis and did not utilize these observations for weather forecasts. Sir Herbert Maxwell, as Chairman of the Treasury Committee on the expenditure of the Meteorological Grant, after rebutting certain allegations as to the conduct of his Committee, replied to the charge that the information telegraphed from Ben Nevis was supplied to the Meteorological Council by the Directors subject to the definite proviso that it should not be published in a "form which would anticipate the daily reports from Ben Nevis which are supplied to the newspapers." It was on this account that the Meteorological Office requested that the telegrams be discontinued, because without the right of publication they could not be utilised. Lord McLaren, in reply, said the observations might have been used for forecasting without publication. We greatly regret the delay in the completion and issue of the report of the Treasury Committee, the earlier appearance of which might possibly have prevented a controversy which seems more likely to hurt than to help the cause of meteorology in Great Britain.

THE GERMAN METEOROLOGICAL SOCIETY held its tenth general meeting at Berlin from April 7th to 9th, 1904. The President, Professor von Bezold, gave an introductory address, visits were paid

to various observatories and places of interest to meteorologists, and the following amongst other papers were read:—On the influence of forests on climate, by Professor Schubert of Eberswalde; On the variations in water-temperature on the western coasts of Europe, by Dr. Meinardus of Berlin; On the thermal régime on the continents, at sea and in the atmosphere, by Professor Schubert; On the tides of the atmosphere, especially on the movements during ebb, by Professor Möller of Brunswick; On the movements of summer rains across Germany, by Dr. Less of Berlin; On precipitation in cyclones, by Dr. Polis of Aix-la-Chapelle; and On the meteorological causes of the winter-killing of grain.

MR. R. C. MOSSMAN, the accomplished meteorologist of the Scottish Antarctic Expedition, has remained in the South Orkney Islands while his companions, after a second cruise to high latitudes, have returned in the "Scotia," and are due to reach the Clyde about the beginning of July. Mr. Mossman has taken charge of a staff of observers from the Argentine Republic, who are supported by their government. The result will be a second year's observations in a most interesting position on the edge of the Antarctic. Mr. Mossman sends a poetical New Year's greeting to his friends (the mails are infrequent) from Omond House, Scotia Bay:—

" From this most salubrious spot, where the weather's never hot,
And the snow keeps merrily drifting all the year,
Where the sun is seldom seen, and the hills are never green,
And the mighty bergs are always very near."

MEASURING THE RAINFALL is the heading of a letter recently addressed to the editor of the *Journal of Commerce*, Liverpool, which runs thus:—

SIR,—The following method of measuring the rainfall may interest and amuse Mr. Hugh R. Mill:—

A good many years ago an old friend of my father's had a rain gauge in his grounds, which he carefully watched and recorded its readings daily. One summer he went from home for a short holiday, and the first thing he did on his return was to visit the gauge, which, to his great surprise, the weather having been fine in the interval, contained a good deal more water than when he had last sounded it. Whilst puzzling over the matter, his old housekeeper came out of the house, and, seeing what her master was after, astonished him by saying: "Oh, sir, it's all right; I put a wee drap in every day since ye went away."—Yours, &c.

April 9th, 1904.

AQUARIUS.

No doubt the anecdote will amuse our readers also.



METEOROLOGY ON THE ANTARCTIC EXPEDITION.

THE Rev. D. C. Bate has been kind enough to forward from New Zealand copies of the *Canterbury Times* for April 13th and 20th, 1904, containing some admirable reproductions of photographs of Antarctic life and scenery, together with descriptive articles on the expedition of the "Discovery," and on the scientific results written from data supplied by the members of the expedition. The meteorological work is described in considerable detail, no less than four and a half columns being devoted to details of the instruments used and the results obtained. So far as actual figures are concerned the only new records quoted are the minimum temperatures for April and May, 1903. These were at the ship's winter quarters, $-43^{\circ}0$ for April and $-52^{\circ}2$ for May, and at Cape Armitage, $-56^{\circ}0$ for April, and $-67^{\circ}7$ for May.

With regard to the anemometers the article says:—

"Of mechanical instruments we have one Robinson cup anemometer, a small Dines', and also another of Dines', which records the maximum force the wind has blown since the last observation, and the mean force at the present time, but as this has not been working at all satisfactory we will not deal with it in this paper. Our anemometers have had their work to do down here, and it cannot be said that they have wholly succeeded. In fact, the constant drift-snow effectually chokes and stops the working of both the Dines'. The Robinson has kept going to a large extent, but has had to be repaired several times, when the cups worked loose, or when snow accumulated inside the works. In the small Dines' the snow not only got inside the head but also down into the piping, and at last effectually stopped any record. The large Dines', which is a self-recording instrument, has been going more or less continually, and very interesting are the curves traced on the sheet, but this, again, soon gets choked, and it is no joy having to climb up the mizzen rigging to clear the head when a gale is blowing, and the temperature is well into the minus sign."

We have also heard from Captain Scott and Lieutenant Royds, but their letters do not contain any facts for publication. They state, however, that from the point of view of scientific observations the second year spent in the shadow (or perhaps we ought to say in the glare) of Mount Erebus was even more successful than the first. It is gratifying to know that so far from the second winter breaking down the health of the ship's company, it was not felt so severely as the first, though the temperatures recorded were considerably lower.



RAINFALL AND TEMPERATURE, MAY, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.]	RAINFALL.					Days on which ≥0.1 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours.				Max.		Min.			
				Depth	Date.	in.		Deg.	Date.	Deg.	Date.	Shade	Grass
I.	London (Camden Square) ...	1.96	+ .40	.36	31	16	76.6	16	34.1	9	0	4	
II.	Tenterden	2.04	+ .23	.47	31	15	77.0	26	34.0	9	0	3	
III.	Hartley Wintney	2.87	+ 1.01	.97	20	15	72.0	29	32.0	9	1	3	
..	Hitchin ..	...	...	...	...	...	...	...	...	...	...	...
..	Winslow (Addington)	2.18	+ .47	.53	20	17	71.0	16	34.0	3, 20	0	5	
IV.	Bury St. Edmunds (Westley) ..	2.14	+ .30	.38	31	15	76.0	27	35.0	10	0	...	
..	Brundall	1.80	- .01	.45	31	13	75.2	26	34.8	10	0	1	
V.	Alderbury	2.86	+ 1.17	.73	27	16	71.0	29	33.0	8	0	...	
..	Winterborne Steepleton ...	4.47	...	1.10	23	18	67.2	16	33.5	20	0	5	
..	Torquay (Cary Green)	2.37	...	.38	30	18	64.0	27, 28	39.3	9	0	0
..	Polapit Tamar [Launceston] ..	2.97	+ .73	.62	1	21	72.8	16	32.7	20	0	2	
..	Bath	1.97	...	.50	27	14	71.0	16	36.2	11	0	...
VI.	Stroud (Upfield)	1.86	- .03	.43	20	14	70.0	29	37.0	10	0	...	
..	Church Stretton (Woolstaston) ..	2.27	- .03	.39	1	17	68.0	16	32.0	8	1	...	
..	Bromsgrove (Stoke Newington) ..	4.01	+ 2.50	2.20	27	15	67.0	26	30.0	...	5	...	
VII.	Boston	1.32	- .18	.50	31	5	75.0	16	33.0	10	0	...	
..	Bawtry (Hesley Hall)	1.74	+ .20	.48	31	14	...	...	...	...	...	...
..	Derby (Midland Railway) ...	1.81	- .04	.46	6	19	74.0	26	35.5	7	0	...	
VIII.	Bolton (The Park)	2.93	+ .19	.49	31	17	70.5	26	34.2	8	0	5	
IX.	Wetherby (Ribston Hall) ...	3.34	+ 1.67	1.13	27	18	...	...	...	...	...	...
..	Arncliffe Vicarage	4.53	+ 1.14	.75	1	21	...	...	...	...	...	...
..	Hull (Pearson Park)	2.12	+ .31	.54	6	17	71.0	13	35.0	10, 20	0	3	
X.	Newcastle (Town Moor)	2.84	+ 1.09	.70	27	17	...	...	...	...	...	...
..	Borrowdale (Seathwaite) ...	7.68	+ .34	1.99	23	18	70.4	26	34.5	8	0	...	
XI.	Cardiff (Ely)	3.04	+ .69	.46	24	20	...	...	...	...	...	...
..	Haverfordwest (High St.) ..	2.93	+ .64	.74	23	18	69.2	29	36.4	4, 11	0	5	
..	Aberystwith (Gogerddan) ..	3.45	+ .93	1.00	27	15	77.0	26	30.0	7, 19	3	...	
..	Llandudno	1.85	+ .02	.54	27	14	76.0	16	36.8	8	0	...	
XII.	Cargen [Dumfries]	2.48	- .16	.68	1	13	69.5	30	33.0	20	0	...	
XIII.	Edinburgh (Royal Observatory) ..	2.88	...	.60	8	21	68.7	16	32.8	8	0	5
XIV.	Colmonell	2.28	- .18	.45	23	16	77.0	29	33.0	19	0	...	
XV.	Tighnabruach	4.34	...	1.12	23	19	65.0	20	32.0	7	1	1	
..	Mull (Quinish)	3.84	+ .69	.98	1	18	...	...	...	...	...	...
XVI.	Loch Leven Sluices	3.25	+ .96	.81	24	19	...	...	...	...	...	...
..	Dundee (Eastern Necropolis) ..	2.50	+ .74	.60	5	20	66.2	29	34.0	8, 12	0	...	
XVII.	Braemar	2.12	- .07	.62	1	15	70.5	30	28.8	12	5	13	
..	Aberdeen (Cranford)	2.86	+ .85	.75	5	18	62.0	25	32.0	11, 19	2	...	
..	Cawdor (Budgate)	2.22	+ .12	.33	26	16	...	...	...	...	...	...
XVIII.	Glencarron Lodge	5.74	+ .49	.68	14, 18	22	75.8	30	32.0	8	1	...	
..	Bendamp.	0.22	+ 2.04	1.25	1	19	...	...	...	...	...	...
XIX.	Dunrobin Castle	1.50	- .43	.37	18	9	61.0	16	35.0	8	0	...	
..	Castletown	1.39	...	.44	26	17	62.0	26, 31	31.0	20	1	...
XX.	Killarney	3.11	+ .06	.81	6	15	68.5	18	34.0	8	0	...	
..	Waterford (Brook Lodge) ..	2.42	- .23	.51	4	15	65.0	28	34.0	4, 11	0	...	
..	Broadford (Hurdlestown) ...	3.00	+ .77	.69	5	15	68.0	29	38.0	24	0	...	
XXI.	Carlow (Browne's Hill)	3.00	+ .70	.79	31	15	...	...	...	...	...	...
..	Dublin (Fitz William Square) ..	2.69	+ .79	1.09	31	18	69.6	16	37.5	8	0	0	
XXII.	Ballinasloe	2.80	+ .35	.87	5	20	74.0	29	32.0	4, 8	2	...	
..	Clifden (Kylemore House) ..	4.44	- .18	1.53	5	15	...	...	...	...	...	...
XXIII.	Seaforde	3.08	+ .77	.79	31	17	73.0	16	32.0	7	1	1	
..	Londonderry (Creggan Res.) ..	2.65	+ .01	.51	31	20	...	...	...	...	...	...
..	Omagh (Edenfel)	2.39	- .15	.47	1	16	71.0	27, 29	36.0	26	0	1	

+ Shows that the fall was above the average; - that it was below it.

SUPPLEMENTARY RAINFALL, MAY, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	2·76	XI.	New Radnor, Ednol	2·21
„	Sheppey, Leysdown	1·79	„	Rhayader, Nantgwilt ...	2·65
„	Hailsham	3·36	„	Lake Vyrnwy	2·82
„	Crowborough	3·45	„	Ruthin, Plâs Drâw.....	1·86
„	Ryde, Beldornie Tower.....	3·42	„	Criccieth, Talarvor.....	2·35
„	Emsworth, Redlands.....	3·76	„	Anglesey, Lligwy	1·50
„	Alton, Ashdell	3·58	„	Douglas, Woodville	3·17
„	Newbury, Welford Park ...	3·22	XII.	Stoneykirk, Ardwell House	2·37
III.	Harrow Weald	2·01	„	Dalry, Old Garroch	3·32
„	Oxford, Magdalen College..	2·89	„	Langholm, Drove Road.....	3·76
„	Banbury, Bloxham.....	2·25	„	Moniaive, Maxwellton House	2·85
„	Pitsford, Sedgebrook	2·22	„	Lilliesleaf, Riddell	2·93
„	Huntingdon, Brampton.....	1·65	XIII.	N. Esk Reservoir [Penicuik]	4·20
„	Wisbech, Bank House .....	...	XIV.	Maybole, Knockdon Farm..	2·70
IV.	Southend	1·65	„	Glasgow, Queen's Park	3·36
„	Colchester, Lexden.....	1·63	XV.	Inveraray, Newtown.....	4·07
„	Saffron Waldon, Newport...	1·39	„	Ballachulish, Ardsheal	6·75
„	Rendlesham Hall	2·46	„	Campbeltown, Redknowe...	2·17
„	Swaffham	1·76	„	Islay, Eallabus	2·97
„	Blakeney	1·51	XVI.	Dollar	3·09
V.	Bishop's Cannings	3·03	„	Balquhilder, Stronvar	5·38
„	Ashburton, Druid House ...	2·92	„	Coupar Angus Station	2·40
„	Okehampton, Oaklands.....	3·51	„	Blair Atholl.....	1·45
„	Hartland Abbey	3·05	„	Moutrose, Sunnyside.....	2·58
„	Lynmouth, Rock House ...	2·77	XVII.	Alford, Lynturk Manse ...	2·88
„	Probus, Lamellyn	2·98	„	Keith, H.R.S.....	2·69
„	Wellington, The Avenue ..	2·39	XVIII.	Fearn, Lower Pitkerrie.....	·86
„	North Cadbury Rectory ...	3·06	„	S. Uist, Askernish	3·48
VI.	Clifton, Pembroke Road ...	3·19	„	Invergarry	5·55
„	Moreton-in-Marsh, Longboro'	3·89	„	Aviemore, Alvie Manse.....	3·67
„	Ross, The Graig	2·11	„	Loch Ness, Drumnadrochit.	3·01
„	Shifnal, Hatton Grange.....	2·03	XIX.	Invershin	1·54
„	Wem Rectory	1·99	„	Altnaharra	1·74
„	Cheadle, The Heath House.	1·98	„	Bettyhill	1·01
„	Coventry, Kingswood	1·32	„	Watten, H.R.S.	1·26
VII.	Market Overton	1·37	XX.	Cork, Wellesley Terrace ...	2·26
„	Market Rasen	1·60	„	Darrynane Abbey	3·28
„	Worksop, Hodsock Priory..	1·96	„	Glenam [Clonmel]	2·93
VIII.	Neston, Hinderton.....	2·10	„	Ballingarry, Hazelfort	3·26
„	Southport, Hesketh Park...	1·74	„	Miltown Malbay.....	1·83
„	Chatburn, Middlewood	3·11	XXI.	Gorey, Courtown House ...	1·99
„	Duddon Valley, Seathwaite Vic.	4·05	„	Moynalty, Westland	2·75
IX.	Langsett Moor, Up. Midhope	3·17	„	Athlone, Twyford	2·21
„	Baldersby	3·84	„	Mullingar, Belvedere.....	2·52
„	Scalby, Silverdale	3·27	XXII.	Woodlawn	2·55
„	Ingleby Greenhow Vicarage	4·18	„	Westport, Murrisk Abbey..	3·09
„	Middleton, Mickleton	3·05	„	Crossmolina, Enniscoo	3·82
X.	Beltingham	2·56	„	Collooney, Markree Obsy...	2·64
„	Bamburgh	2·36	XXIII.	Enniskillen, Portora	1·97
„	Keswick, The Bank	3·30	„	Warrenpoint	2·33
„	Melnerby Rectory.....	4·51	„	Banbridge, Milltown	2·19
XI.	Llanfrechfa Grange.....	3·12	„	Belfast, Springfield	2·92
„	Treherbert, Tyn-y-waun ...	4·96	„	Bushmills, Dundarave	2·41
„	Llandoverly, Tonn	2·61	„	Stewartstown	2·51
„	Castle Malgwyn	1·78	„	Killybegs	1·80
„	Llandefaelog-fach	2·29	„	Horn Head	2·05

METEOROLOGICAL NOTES ON MAY, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The absence of E. wind, and a sufficiency of sunshine and warm R, following a particularly mild April, combined to produce one of the most beautiful spring months for many years. The average amount of cloud for the month was 7·3, the highest on record, but there were nevertheless many magnificent days, especially in the first and third weeks. The duration of sunshine was 128·4* hours and of R 58·2 hours. Mean temp. 54°·6, or 0°·6 above the average,

TENTERDEN.—A pleasant spring month without much wind, though somewhat deficient in sunshine. Rather cold from 3rd to 11th and about 20th. Great abundance of blossom in orchards and on hawthorn and flowering shrubs. Duration of sunshine 158† hours.

CROWBOROUGH.—A very changeable type of weather. Mild on the whole, with frequent fog, mist and haze. Mean temp. 51°·8.

HARTLEY WINTNEY.—A "Janus-like" month, with one face excessively dry, the other remarkably wet. Cold N.W. wind for the first 19 days, then S.W. to the end. Ozone on 15 days with a mean of 2·9.

BRUNDALL.—Very fine, and the warmest May since 1895. From 8th to 20th it was absolutely rainless, this being the longest period without R since the end of June, 1903. Fruit blossoming proceeded almost without a check, promising an abundant crop.

WINTERBOURNE STEEPLTON.—The wettest May since the record began in 1893.

TORQUAY.—R 37 in. above the average. Duration of sunshine 183·3* hours, or 38·0 hours below the average. Mean temp. 52°·8, or 0°·3 below the average. Mean amount of ozone 5·7; max. 8·0 on 2nd with W. wind, and min. 1·5 on 27th with N.N.E. wind.

LYNMOUTH.—Fairly warm, with no heavy gales. The range of bar. was only ·65 in.

WELLINGTON.—Very seasonable on the whole, but R 75 in. above the average.

NORTH CADBURY.—A very good average May, but no settled weather. Temp. normal, the max. being a little lower and min. higher than usual. Fruit blossom was very abundant.

CLIFTON.—The first 10 days were rainy and cool; then fair and warmer till 19th, but not much sunshine. The remainder was rainy and unsettled. No frost. R 92 in. above the average.

ROSS.—Average temp. and R, but more rainy days than usual. Much fine weather from 2nd to 20th, then frequent R to the close. Vegetation was very luxuriant and flowering shrubs unusually full of blossom.

WEM.—Showery and cold in the first half, without much sun and very damp on several days. Vegetation was well advanced and more than usually luxuriant.

BROMSGROVE.—On 27th 2·20 in. of R fell in about 10 hours. This fall has only been exceeded twice in 28 years.

WORKSOP.—Dry till near the end, and the R of the last few days was very welcome. Crops looked well and there was an unusual profusion of bloom on all trees and shrubs.

* Campbell-Stokes.

† Jordan.

BOLTON.—Very slight range of pressure and temp. The amount of cloud was much in excess, and the sunshine and evaporation were the least yet recorded. Mean temp. $48^{\circ}8$, or $1^{\circ}0$ below the average. Duration of sunshine $92\cdot5^*$ hours, or $63\cdot3$ hours below the average.

SOUTHPORT.—The most sunless May in 13 years' record, the mean being 69^* hours below the average. Otherwise fairly normal. R $\cdot38$ in. below the average, the duration being only $40\cdot7$ hours. Mean temp. $0^{\circ}3$ above the average.

HULL.—The early part was variable and frequently cold. Brighter from 14th to 20th, but very cloudy and milder towards the end. Duration of sunshine $79\cdot2$ hours.

LLANDOVERY.—Cool and changeable especially after the 7th, but on the whole favourable to vegetation.

HAVERFORDWEST.—Fine but cold, with just sufficient R. Vegetation luxuriant, with a promise of abundant harvests. Duration of sunshine $125\cdot2^*$ hours.

DOUGLAS.—A repetition of February, March and April. Temp. persistently below the average and remarkable deficiency of sunshine. Gales blew for about half the month chiefly from N. Fruit blossom was prolific and foliage good, but spring was extremely late.

SCOTLAND.

LANGHOLM.—R $\cdot77$ in. above the average of 28 years.

MAXWELTON HOUSE.—A fine month, the first half being cold and the second warm. R $\cdot24$ in. below the average. S on 2nd.

LILLIESLEAF, RIDDELL.—R $\cdot93$ in. above the average. There was an excessive amount of blossom on fruit trees, probably owing to the absence of insects caused by last year's R.

INVERARAY.—The first half was cold and showery and everything very backward, but the last few days were quite hot.

BALLACHULISH.—R $3\cdot18$ in. above the average.

COUPAR ANGUS.—R and temp. slightly above the average. The first two weeks were cold and wet, but it was fine afterwards.

WATTEN.—The first half was dry, with cold, stormy winds; the latter half dry, mild and fine, particularly the closing week.

CASTLETOWN.—Cold and windy till 20th, afterwards warm and dry, the last few days being very dry and dusty. TS lasting nearly 2 hours on 26th.

IRELAND.

CORK.—Temp. $3^{\circ}8$ below the average, and R $\cdot08$ in. above the average. On 8th the min. temp. $32^{\circ}0$, the latest frost in 21 years.

DUBLIN.—The month opened and closed with heavy R, but the rest was fine though changeable. Very cold from 5th to 10th. H on 7th, 8th and 17th.

MARKREE OBSERVATORY.—Frequent R and H showers, with strong S. and S.W. winds, in the first half. Fine weather after 17th.

BELFAST.—A very satisfactory May, with many fine summer days. R $\cdot07$ in. above the average.

OMAGH.—The greater part was rather cool, blustering and unsettled, but practically without frost. The foliage and flowers, including that of fruit trees, was therefore more abundant and luxuriant than for many years. The month went out in settled summer weather.

Erratum.—In the notes for April, 1904, the mean temp. at Camden Square should be $50^{\circ}3$ not $48^{\circ}1$, and the difference from the average $2^{\circ}2$, not $2^{\circ}4$.

* Campbell-Stokes.

Climatological Table for the British Empire, December, 1903.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.			Total Rain. inches.	Days.	Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.			
	Temp.	Date.	Temp.	Date.										
London, Camden Square	52·3	9	26·1	31	42·6	35·5	36·3	92	59·2	19·1	1·30	12	8·4	
Malta	70·2	11	43·2	8	63·1	52·0	51·5	75	107·2	40·2	3·55	14	4·3	
Lagos, W. Africa	91·0	8	71·0	20	87·8	75·2	77·5	75	143·0	70·0	1·23	5	3·6	
Cape Town	90·8	14	50·2	21	76·6	67·9	56·5	68	...	...	·45	4	3·1
Durban, Natal	92·3	25	59·8	13	83·3	66·5	...	...	145·9	...	5·33	20	5·3
Mauritius	88·2	2	65·4	7, 11	83·8	69·3	66·2	72	153·8	60·8	2·74	21	6·1	
Calcutta	80·4	12	49·8	16	76·3	54·0	52·8	65	135·0	42·5	·00	0	0·9	
Bombay	91·2	3	56·0	27	84·7	68·5	63·4	65	138·5	48·9	·00	0	0·7	
Madras	86·2	2	65·3	8	81·3	69·7	68·4	82	135·2	61·6	19·63	11	5·0	
Kodaikanal	65·3	24	42·7	14	60·4	47·2	42·9	71	129·3	29·2	12·06	9	4·2	
Colombo, Ceylon	90·0	4, 20	70·2	15	79·0	74·1	70·7	79	155·8	66·5	·92	7	4·5	
Hongkong	74·7	15	45·8	21	66·9	56·0	45·6	56	124·1	...	·09	2	3·5	
Melbourne	95·6	26	45·5	4	72·7	55·5	53·6	74	152·2	38·4	2·30	9	6·1	
Adelaide	99·7	26	46·9	2	80·3	57·9	52·0	53	160·5	47·0	1·16	6	3·5	
Coolgardie	...	...	...	...	...	...	...	...	...	...	...	...	...
Sydney	86·5	12	57·5	17	75·5	63·3	53·7	67	129·2	48·9	3·93	20	6·0	
Wellington	78·7	9	48·5	27	70·9	55·8	51·9	67	138·0	44·0	1·81	11	6·0	
Auckland	77·0	28	56·0	13	71·5	59·5	55·7	71	147·0	52·0	3·26	14	4·2	
Jamaica, Negril Point.	87·9	15	65·0	9	85·2	70·5	68·0	71	...	...	·56	3	...
Trinidad	90·0	sevl	67·0	sevl	87·7	70·6	72·3	83	166·0	61·0	4·20	15	...	
Grenada	87·2	11	70·8	29	83·6	73·1	69·3	70	154·2	...	12·49	24	3·6	
Toronto	39·2	13	-9·7	28	29·6	16·2	17·8	81	45·8	-13·5	1·99	25	7·9	
Fredericton	49·8	21	-10·7	29	27·0	6·5	5·5	61	...	...	3·36	8	5·8
Winnipeg	32·0	2	-29·8	25	13·2	-8·8	...	...	...	...	1·02	10	5·6
Victoria, B.C.	51·3	15	34·3	2	45·9	40·1	...	...	...	...	2·41	16	8·1
Dawson	32·4	23	-40·0	13	6·0	-5·0	...	...	...	...	·11	2	4·5

MALTA.—Mean temp. of air 56°·6 or 0°·4 above, mean hourly velocity of wind 10·2 or 1·0 below, averages. Mean temp. of sea 62°·7. TSS on 3 days; L on 29th.

Mauritius.—Mean temp. of air 2°·0, dew point 1°·9, and R 2·11 in., below averages. Mean hourly velocity of wind 11·1 miles, or 0·2 below average; mean direction E. by S.

MADRAS.—Bright sunshine 149·2 hours. Max. daily R 8·20 in. on 30th.

KODAIKANAL.—Mean temp. of air 52°·6. Mean velocity of wind 361 miles per day. Bright sunshine 168·6 hours.

COLOMBO, CEYLON.—Mean temp. of air 79°·0 or 0°·2, of dew point 0°·2, and R 2·20 in. or 4·06 in. below, averages. Mean hourly velocity of wind 9·2 miles, prevailing direction N. and N.W.

HONGKONG.—Mean temp. of air 61°·1. R ·92 in. below average. Bright sunshine 222·3 hours, or 32 above average. Mean hourly velocity of wind 12·0 miles; prevailing direction N.E. by E.

Adelaide.—Mean temp. of air 2°·0 below, R ·30 in. above, average. Some severe TSS.

Sydney.—Mean temp. of air 0°·5 below, humidity 1°·4 below, and R 1·39 in. above, average.

Wellington.—Mean temp. 6°·4 above, R 1·93 in. below, averages.

TRINIDAD.—R ·60 in. below the 40 years' average.

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THE REPORT OF THE METEOROLOGICAL COMMITTEE.

IN December, 1902, the Prime Minister appointed a Committee consisting of Sir Herbert Maxwell, M.P., F.R.S., Mr. J. A. Dewar, M.P., Sir W. de W. Abney, F.R.S., Sir F. Hopwood of the Board of Trade, Sir T. H. Elliott of the Board of Agriculture, Mr. T. L. Heath of the Treasury, Dr. R. T. Glazebrook, F.R.S., and Prof. J. Larmor, Sec.R.S., "to enquire and report as to the administration by the Meteorological Council of the existing Parliamentary grant, and as to whether any changes in its apportionment are desirable in the interest of Meteorological Science, and to make any further recommendations which may occur to them with a view to increasing the utility of that grant."

The Committee held twelve meetings for the examination of witnesses and received evidence from twenty-two representatives of various scientific bodies and government departments, whose names, in the order in which they were called, are given below:—General Sir R. Strachey, F.R.S., Chairman of the Meteorological Council; Dr. W. N. Shaw, F.R.S., Secretary of the Meteorological Council; Sir Michael Foster, M.P., F.R.S., Secretary of the Royal Society; Sir John Murray, F.R.S., Chairman of Directors of Ben Nevis Observatories; Dr. A. Buchan, F.R.S., Secretary of Scottish Meteorological Society; Admiral Sir W. Wharton, F.R.S., Hydrographer to the Admiralty; Commander D. Wilson Barker, R.N.R., President of the Royal Meteorological Society; Mr. W. H. Christie, F.R.S., Astronomer Royal; Mr. J. MacDonald, Secretary of Highland and Agricultural Society; Sir Norman Lockyer, F.R.S., Director of the Solar Physics Observatory; Lord Kelvin, F.R.S.; Professor George Darwin, F.R.S., Professor of Astronomy at Cambridge; Dr. R. T. Glazebrook, F.R.S., Director of the National Physical Laboratory; Mr. R. T. Omond, Hon. Sec. Scottish Meteorological Society; Mr. E. K. Spiegelhalter, Optician, Malton, Yorks; Dr. H. R. Mill; Professor A. Schuster, F.R.S., Professor of Physics in Manchester; Mr. R. N. Grenville, of

the Royal Agricultural Society; Sir E. Verney, Steeple Clayden, Bucks; Captain A. MacDonald, Commander of Scottish Fishery Board's cruiser; Rev. V. F. Willson, Rector of Fullbeck, Lincolnshire; Mr. R. A. Dawson, Superintendent of the Lancashire Sea Fisheries.

The Committee has now issued its report, dated 16th May, 1904, and the full evidence of all the witnesses is also published.* Both documents should be studied by all who have the science of meteorology at heart and who desire to see it promoted for the benefit of the public. The report is important, the evidence is interesting in a high degree, and we do not hesitate to devote a large part of our space to the subject this month. The logical order would be to begin with the evidence and then consider the report; but as we are entirely in agreement with the majority of the Committee and consider that a better or fairer report could hardly have been based on the evidence before them, we shall in this article consider the report in detail and leave the evidence in the meantime.

Sir Herbert Maxwell's Committee considered five special points, and after a preliminary remark on the first, we summarise the conclusions seriatim without further comment until the end. The constitution of the Meteorological Council does not appear to have been understood before by the general public, and we confess that, like the reverend gentleman on the golf course, although we might never have uttered such a word ourselves, we felt a sense of relief when *The Times* "said it for us" and referred to the Council "as bearing a considerable analogy to the arrangements of comic opera."

The substance of the Report is as follows:—

(a) *Constitution of the Meteorological Council.*—The Meteorological Council is constituted upon a system which bears no analogy to that of other departments, administering money voted by Parliament. In 1856 a Meteorological Department of the Board of Trade was formed in accordance with the advice of the Royal Society, and placed under the control of Admiral FitzRoy. On his death, in 1865, a committee consisting of one representative each of the Board of Trade, the Admiralty, and the Royal Society, inquired into the work accomplished, and in conformity with its report, the control of the Meteorological Department was handed over, in 1867, to the Royal Society, who, in consideration of an annual grant of £10,000, undertook to appoint a standing committee (unpaid) to carry on the work, and established the Meteorological Office.

The Royal Society had first tried, but failed, to induce the Board of Trade to separate the collection and discussion of scientific data from the issue of storm warnings, considering that the latter should remain under a Government Department.

Nine years later, in 1875, another committee was appointed by the Treasury to review the work of the Meteorological Office. As a result of its

*Meteorological Grant Committee. Vol. I., Report. Size 13 × 8½. Pp. 20. Price 2½d. Vol. II., Evidence and Appendices. Size 13 × 8½. Pp. 122. Price 1s. [Cd. 2123, 2124.] London, Eyre and Spottiswoode, 1904.

report, the committee charged with the administration and control of the Meteorological Office was reconstituted in 1877 as the Meteorological Council, receiving an annual grant of £14,500, which was increased in subsequent years to £15,300, where it now stands.

The Council consisted of a chairman and four other members, all nominated by the Royal Society, £1,000 being allotted out of the grant for their remuneration. In addition to these, the Hydrographer was appointed *ex officio* a member of the Council. This arrangement was regarded as provisional and the Committee recommended its revision at the end of five years. The Royal Society pressed upon the Treasury, at this time and again in 1881, their view that the Meteorological Office should be constituted as "a Government Department, with a man of science, responsible to a Minister of the Crown, at the head of it." This view was not shared by the Government.

In 1901,* having obtained the approval of the Royal Society, the Council was incorporated under the Companies' Acts with a license from the Board of Trade enabling them to dispense with the word "limited," in order to obtain such benefits as limited liability, perpetual succession, and the right to sue.

The members of the Council became the Directors of the Association. But, whereas the statute requires that an association to be registered must consist of not less than seven persons, it became necessary to add to their number, which was done by the election of five members, the executive functions remaining exclusively in the hands of the five directors receiving emolument.

Thus was constituted what must be pronounced a singular anomaly—viz., a limited liability company, managed by a Board of five Directors receiving pay out of a grant made by Parliament, appointed by and presenting its annual report to the Royal Society, submitting its accounts for audit to the Comptroller and Auditor-General, but held bound under its Memorandum and Articles of Association to "observe any lawful conditions or directions imposed or given by the Lords Commissioners of the Treasury to the administration of the said grant or the form of receipt to be given for payment of it."

(b) *Administration of the Annual Grant.*—Out of the sum of £1,000 a year originally assigned by the Treasury for the remuneration of the Directors, £875 is applied as follows, under the scheme approved by the Royal Society in 1900:—£300 to the chairman, £50 retaining fee to each of the Directors other than the Chairman and the Hydrographer. The balance remaining, £425, after deducting travelling expenses, is divided among the Directors, other than the Chairman, in proportion to their attendance at meetings, provided that no such Director shall receive more than £125 in any year in that way.

The staff in the Meteorological Office consists of a Secretary with a salary of £625 supplemented by his Director's fee of £125, a Marine Superintendent with £400, twenty-five classified clerks receiving various salaries from an initial £75 to a maximum of £275, fifteen other clerks, messengers, etc., and a special assistant to the Secretary for scientific investigations. The staff is distributed amongst five branches, viz.—The Secretary's Office, the Marine Branch, the Forecast and Storm-Warnings Branch, the Observatory Branch, and the Statistical and Library Branch. The grant is allocated amongst the branches as follows:—

* The Report gives the date as 1891, but that is a misprint.

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Council and Secretary.....	£1,475
Secretary's Office, including rent	2,000
Marine Branch.....	2,434
Forecast Branch	3,560
Statistical and Library Branch.....	912
Observatory Branch	2,633
Inspections	400
Special Researches	726
Superannuation	1,220

Total..... £15,360

The Marine Branch spends on the average £522 per annum in supplying meteorological instruments to ships of the Royal Navy, and £260 for a similar service to the mercantile marine. The Forecast Branch pays £2,060 to the Post Office, £260 for postage and £1810 for telegrams, which are charged at the ordinary rate and being subject to the usual conditions, frequently fail to be delivered in time. During the winter of 1902-03, storm-warnings were telegraphed to Tenby on 11 occasions at 7.30 p.m., and on 6 of these occasions they were not delivered until the following morning, 14 hours after the observations, on which they were founded, had been made. On another occasion the Post Office accepted 120 storm-warning telegrams one Sunday, charging 6d. each and an extra fee of 1s. each for Sunday delivery, and yet only 19 were delivered that evening, the £7 11s. 6d. paid for the others being absolutely wasted. The Library is inadequately housed, and as it contains 17,000 books and pamphlets to which 1,500 are added each year, the want of space is increasingly felt. The offices also are low-roofed and ill-ventilated, and the general routine of office work is estimated by the Council to demand an additional expenditure of £700 per annum.

With regard to the Observatory Branch the Council have been paying £1,910 per annum towards the maintenance of five observatories, viz. : Kew, Valencia, Falmouth, Aberdeen, and Fort William. They also receive observations from the observatories maintained by Stonyhurst College and Glasgow University.

Attention has been specially directed to the recent decision of the Council to discontinue the payment of £250 per annum to the Fort William Observatory, which was established as subsidiary to the observatory at Ben Nevis.

The important question whether the observatories should be retained or abandoned has been most carefully considered. The evidence on the subject is conflicting. Lord Kelvin still holds to the opinion expressed at the meeting of the British Association in 1887 that "the Ben Nevis observations are of the highest utility in the development of meteorology, and in framing forecasts of storms and weather," and he is of opinion that it is a matter for regret that these observations have not been used by the Meteorological Council in preparing their forecasts and warnings. On the other hand, Professor Schuster is of opinion that "the problems which could with convenience be carried out at Ben Nevis Observatory have been dealt with," and that further observations would be superfluous unless some definite problem were set for solution.

After weighing all the circumstances, it appears, that, on public and economic grounds, it would constitute a bad bargain to allow the observatories to disappear. Such a proceeding would involve the sacrifice of a large capital outlay which has been expended upon works, and the loss of the property and "good-

will" subsisting in the maintenance of the building and plant. It appears that only £350 per annum is required to insure the continued maintenance of the observatories, and every effort should be made to provide this small sum for the purpose.

Full accord has not always existed in the past between the Meteorological Council and the Directors of the Ben Nevis Observatory, and it seems that as a condition precedent to a continuance of the grant of £350, arrangements should be made for (1) a reorganisation of the management of these observatories, (2) a consideration of the general scientific purposes for which they might be used, (3) framing, with the assistance of meteorologists, a scheme defining the lines of investigation which should in future be undertaken at Fort William and Ben Nevis, and (4) securing to the Office the full right to publish telegraphic reports from Ben Nevis along with those from other stations.

With regard to meteorological research the Council has made a strong representation to the effect that the staff wants strengthening by the addition of assistants specially qualified by a knowledge of mathematics and physics, three such assistants would cost, with incidental expenses, £2,250 per annum. It also appears from the evidence that it would be desirable for the Council to have access to a meteorological laboratory properly equipped, which would serve as one of their first-order observing stations.

It appears that the present constitution of the Meteorological Office was never regarded by the Royal Society as a permanent one, but as "a temporary measure till some other organisation should be carried out." This seems to be a favourable opportunity for placing the Meteorological Office upon a permanent footing.

(c.) *Utility to the Public of the work of the Meteorological Council.*—The utility of the Maritime Branch is conceded; but some attention must be given to the work of the Forecast Branch in this particular, and the matter has been carefully enquired into.

Sea-faring men on all parts of the British coast where storm signals are displayed have become accustomed to regulate their movements in compliance with them. The fishing population also recognise their utility, although the increased use of steam trawlers has made fishing vessels less dependent on fair weather than formerly. It cannot be doubted that the system of storm-warnings has been effective in the protection of life and property at sea.

Farmers in those districts where timely information can be obtained are learning to take advantage of weather forecasts; but there is considerably more difficulty in distributing forecasts over wide agricultural districts than in communicating them to the centres of fishing population and coasting marine. Witnesses from different agricultural districts, remote from each other, estimate the proportion of accuracy in weather forecasts at from 70 to 90 per cent. It is to be regretted, therefore, that no effort seems to have been made on the part of agricultural societies to co-operate with the Council in the dissemination of this kind of information.

In the opinion of the Committee the economic value of weather forecasts and storm-warnings amply justifies the cost of maintaining them—a value which perhaps the public would never fully recognise until they should be discontinued.

After dealing with matters as they are at present, the Committee proceeds to recommend certain measures with a view to improvement,

and these are so important that we give them in the exact words of the Report :—

We are of opinion that the registration of the Meteorological Office as a company under the Joint Stock Companies' Act should be cancelled, that the company should be wound up, and the office reconstituted as a department under the control of the Board of Agriculture and Fisheries.

The necessity for a Council of seven having thus been got rid of, we recommend that the office be placed under the control of a man of science as Director of Meteorology, appointed after consultation with the Royal Society, but responsible to the Board of Agriculture and Fisheries, and making his annual report to that Department. We recommend also the appointment of an advisory board, consisting of the Hydrographer to the Admiralty, a representative of the Board of Trade and one of the Board of Agriculture and Fisheries, and two members nominated by the Royal Society. The functions of the advisory board should be consultative only, the Director being responsible to the Board of Agriculture and Fisheries for administration.

We recommend also that a second officer be appointed to act as scientific assistant to the Director, to assist him in the general management of the office and in the discussion of such scientific problems as may arise.

The mean annual cost of this arrangement, as compared with that for the present Council, we estimate thus :—

PRESENT ARRANGEMENT.				PROPOSED ARRANGEMENT.			
Council ... ..	..	...	£850	Director ...	£800 rising to	£1,000	
Secretary ... ..	...	...	£625	Scientific Assistant ... ..	...	£450	
			<u>£1,475</u>	Mean ... ..	...	<u>£1,350</u>	

The fixed Parliamentary Grant £15,300 should be transferred to the vote for the Board of Agriculture and Fisheries.

Under such an arrangement the anomaly would cease of what is practically a department of the public service, though nominally a joint stock company, paying for postal and telegraph services money out of its fixed income. The charge for these services would not appear in the estimate, though undoubtedly the revenue would be the loser by the amount now repaid out of the Parliamentary grant. The Director of Meteorology would not then feel, as the Council now do, that the more complete and rapid the distribution of forecasts and warnings is made, the less money remains for scientific research and for overtaking arrears in the statistical work of the department.

Further, we judge it important that the Post Office should make arrangements at the 27 reporting stations in the United Kingdom for the transmission of daily telegraphic reports one hour earlier than the present one of 8.15 to 8.30 a.m., and that storm warnings should, if practicable, have priority over all private messages at all hours.

We would call attention to the expediency of testing the efficacy of wireless telegraphy in providing advance news of weather in the Atlantic. Such news would incalculably strengthen the forecast and warning service, and might, we believe, be obtained regularly over an experimental period by co-operation either with the Admiralty, the Ocean Steamship Companies, or both. We would urge that no unnecessary delay should take place in organising this experiment.

We recommend that in future the cost of instruments supplied to His Majesty's ships be borne upon the Navy Votes, except where such instruments are intended for use in research or observation specially called for by the Director of Meteorology.

We consider that the premises now rented by the Council are neither suitable in character nor adequate in space for the present requirements of the office, and that others should be provided wherein the staff might perform their duties under more favourable hygienic conditions, and necessary accommodation for the rapidly growing library might be secured.

We recommend that the staff employed in the library, the statistical branch, and observatory branch, should be augmented. The steps necessary to give effect to this and the preceding recommendation can best be determined when the future of the office has been decided upon.

In default of an increase to the grant the small increased expenditure which we have recommended would have either to be postponed, or to be met from economies on other branches of the work of the office.

Unfortunately, the Committee was not unanimous in its report, various portions of it being taken exception to by different members. Thus, Sir Herbert Maxwell and Sir Wm. Abney dissent with some emphasis from the recommendation to continue support to the Ben Nevis observatories on the ground that their utility has not been proved. After stating reasons for this view, they conclude—"We are thus led to the conclusion that there is no ground for interfering with the discretion of the Meteorological Council in withdrawing their subsidy to these observatories and applying the £350 thus released to what they may consider more profitable methods of research." But they allow that an increase of the Parliamentary grant would alter the case.

Mr. Dewar dissents from the approval implied in the Report of the superannuation scheme adopted by the Council, on the ground that a large annual charge for pensions ought not to be made on a fund voted annually for a specific purpose.

Finally, Sir Francis Hopwood and Mr. Heath, representing the Board of Trade and the Treasury, object to all the recommendations of the Committee which involve an addition to the annual grant, on the ground that such matters were outside the reference, and they also object to the transference of the meteorological grant from the Vote for Scientific Investigations, &c., to the Vote for the Board of Agriculture and Fisheries, because they consider that the time has come for an inquiry into the whole question of grants in aid of scientific work.

It is a misfortune that the Report is not unanimous, for it may give the Government an opportunity to delay the steps necessary to give effect to those recommendations on which all were agreed. The difficulties raised do not strike us as overwhelming. If the Meteorological Office is reconstituted, with a Director of recognised scientific position and administrative ability at its head (and no better man than the present secretary could be found), it would surely be safe

to leave to him the responsibility for continuing or discontinuing the grant to any of the present observatories. The economies suggested by the substitution of a Director and scientific assistant with an unpaid advisory body for the present Council and Secretary would have the effect of practically increasing the grant, and after all the cost of one torpedo a year would not be money thrown away if it improved our knowledge of the weather. It would, in any case, be unwise to hamper the prospective Director by any definite instructions as to what he must do in any special case, the urgency of which may vary as time goes on.

It surely does not matter on what vote the money is given, so long as it is expended in the right way for the proper purpose and is as free as possible from the trammels of red tape. The Royal Society it appears never liked the constitution of the Meteorological Council, were always anxious to change it, and would view its reorganization as a Government department without regret. The Board of Agriculture and Fisheries has shown itself to be energetic and reasonable in the control of the Ordnance Survey, an institution in many ways akin in its relation to the public to the Meteorological Office, and the practical applications of meteorology apply mainly to the two great national industries the oversight of which is now under the charge of the Board. The feeling is unanimous that the anomalous Meteorological Council should cease and that a Government department should accept responsibility for the national weather service. But we cannot too strongly emphasize our opinion that the Government department must give an absolutely free hand to the Director of Meteorology and not exhaust his strength in trivial details or in trying to carry out or to evade vexatious regulations.

With one point in the decisions of the Committee we are particularly pleased. That is the frank manner in which the Post Office has been condemned for the obstruction it has systematically thrown in the way of the work of the Meteorological Office. In a smaller degree but no less vexatiously we have ourselves suffered from the perversity of Post Office officials with regard to regulations as to the postage exacted on meteorological communications not of the nature of a letter; and although the late Mr. Symons failed to obtain redress, even in Parliament, we trust that when the Treasury takes the matter up, the Post Office may at last be convinced that their function is to facilitate and not to frustrate the transmission of important information.

The Directors of the Ben Nevis Observatory deserve to be congratulated on the result of their public-spirited appeal to Parliament; for not only is the continuance of high-level meteorology insisted on in the Report of the Committee, but a reform in the treatment of meteorology in this country has been brought within sight which promises to be of high utility to the science and its applications.

We would suggest one modification in the recommendation as to an advisory Committee, which is that it be increased by the addition of a member nominated by the Royal Meteorological Society. This would in no way detract from the recognised position of the Royal Society as the scientific advisors of the Government, for an exact precedent is to be found in the constitution of the Board of Visitors at Greenwich, and we claim the same privilege for the Royal Meteorological Society in connection with Government meteorology which is conceded to the Royal Astronomical Society in the case of Government astronomy.

A NEW METEOROGRAPH FOR KITES.

BY W. H. DINES.

THE want of a reliable meteorograph at a moderate cost is one that is often felt by those engaged in obtaining meteorological observations by means of unmanned balloons and kites, and it has been, to me at least, a serious difficulty in my work. The requirements are somewhat out of the common; the meteorograph must be light, it should offer little resistance to the wind, and the control over the pens should be sufficiently powerful to prevent the blurring of the trace by the violent shaking to which the instruments are at times exposed. It is also very desirable that no change of position, such as an alteration of level, should be able to alter the positions of the pens on the paper. It is hoped that these requirements are met in the instrument here described, and made by Mr. J. J. Hicks, of 10, Hatton Garden, London, E.C.

Simplicity of construction and small surface are secured by letting the pens write upon a circular paper disc of about 11 or 12 inches diameter instead of on a clock drum. This disc turns on a pin passing through a hole in its centre and lies on a flat piece of thin wood. It is turned at any rate that may be desired by an ordinary small clock, the paper near its circumference being pressed against the milled wheel that is used for setting the hands, by a small roller mounted on a spring.

The height, or more strictly the air pressure, is given by an aneroid box of $2\frac{3}{4}$ inches diameter. This box is formed of thin metal and is left full of air. There is in consequence a fairly large temperature correction to be applied, but, on the other hand, the elasticity of the enclosed air is perfect, and the elasticity of the metal plays a comparatively small part in determining the position of the pen. A stud on the box presses against a lever, and the other end of the lever is formed into a pen of special construction, which

will not easily blot. There is no difficulty in getting a sufficiently open scale by this means.

The thermograph consists of a coil of fine thin brass tube in communication with an aneroid box of about $1\frac{1}{4}$ in. diameter. The tube and aneroid box are completely filled with ether. Ether is chosen because its co-efficient of expansion is greater, and its specific heat less, than that of spirit, and in consequence the thermograph is more sensitive than it would be with alcohol. The expansion of the ether expands the aneroid box, and the motion of the face of the box is communicated to the pen by a single lever, just as in the case of the aneroidgraph. Any temperature scale can be arranged for, but 40° F. to one inch allows readings to be obtained with certainty within 1° F. in so far as deciphering the trace is concerned. Of course there is a certain lag, but it appears to be less than that of the ordinary mercurial thermometer.

The humidity-graph is obtained by the alteration in length of a few human hairs six inches long, the pen lever multiplying this eight times. Thus the pen exhibits on the paper the contraction and expansion of 4 ft. of human hair. The scale is about $\frac{1}{2}$ in. long.

It is hoped at some future time to add an anemograph.

The outside dimensions of the whole arrangement are 15 in. by 12 in. by 3 in. The paper disc, pens, clock, etc., enclosed and are protected from rain by a varnished linen cover, and the weight of the instrument, including the means of attachment to the kite, is about $1\frac{3}{4}$ lbs. The meteorograph is sent up in the kite, and is secured by four pieces of strong string running from its four corners to the top and bottom of the side sticks. It thus lies in the air slightly inclined to the wind, and advantage is taken of this position to protect the thermometer tube and hygrometer hairs from the sun. They are placed underneath where the wind blows freely over them and they must be in shadow unless the sun be low down on the horizon in the direction from which the wind is blowing. They are also thus protected from rain, but it is not possible to protect them from the driving fog particles of a cloud, and these are as wetting as rain.

Printed paper can be used, but it is simpler to cut circular discs of the required size out of ordinary drawing paper, and to decipher the traces by placing them under an engraved thin celluloid disc.

I have now used these instruments for a period of three months in all kinds of weather, and although on one occasion they were inadvertently placed in the kite upside down, they have on every occasion given a perfectly distinct trace free from blurring and easily decipherable.



Correspondence.

To the Editor of Symons's Meteorological Magazine.

BALL LIGHTNING.

AT the recent meeting of the Royal Meteorological Society considerable doubt was expressed as to the objective reality of the above phenomenon, and I have made some enquiries into the matter with the following result.

Some years since (it is unfortunately impossible to fix the exact date) Miss Norton, while watching a very heavy thunderstorm one afternoon, witnessed a phenomenon which was certainly like "ball lightning."

She says:—"I was seated near the window working, when there came a sudden crash, and a *ball of fire* fell into the garden disappearing immediately into the earth. It did *not* explode or break into pieces.

"The following day I was invited to go in to the next house to see the damage done by the lightning, which was very great, the fireplace and chimney-piece being wrenched from their position, and the furniture in the room demolished.

"It would therefore seem that the electric ball descended the chimney of my neighbour's house, and, having wrecked the room, proceeded into the back garden, then, bounding over the wall, it disappeared in my own garden, much to my alarm. I regret to say that as that time my fear exceeded my interest in the matter, I did not go into the garden to look for traces of where the lightning entered the ground, and the subsequent very heavy rains erased all marks."

This, then, is the authentic statement of an eye-witness of the phenomenon of ball lightning, and I venture to think that instead of definitely stating that such lightning never occurs, it would be better to assume that although it is possible it is at the same time *very* rare.

D. W. HORNER.

Clapham Park, S. W., June 24th, 1904.

[We think that Mr. Horner scarcely grasps the difficulty with regard to "ball lightning." No one denies that it has frequently been seen; the problem is whether the appearance of a ball of fire is the image of a real fireball, or is merely a subjective impression of some luminous phenomenon which may not be produced by a globular body at all.—ED. *S.M.M.*]

A THREE YEARS' PERIOD IN RAINFALL.

I HAVE just read Mr. Jenkin's communication in your June number, and I send you the result of an examination of my 30 years' observations at Montfaucon d'Argonne, near Verdun. The site is an

isolated hill of 1,150 feet altitude. The results show no agreement with those obtained at Trewirgie, nor do those at Paris for the same period which I add for comparison:—

MONTFAUCON D'ARGONNE.				PARIS (TERRASSE).			
Date of Col. I.	I.	II.	III.	Date of Col. I.	I.	II.	III.
1873.....	—	22·05	30·21	1873.....	—	16·62	20·06
1876.....	31·59	40·29	39·44	1876.....	20·44	23·71	24·82
1879.....	34·81	38·52	36·50	1879.....	17·66	19·05	19·06
1882.....	46·46	41·38	30·27	1882.....	21·81	18·78	14·61
1885.....	30·86	45·22	32·43	1885.....	19·80	22·95	16·89
1888.....	47·27	39·57	30·72	1888.....	16·73	18·23	17·68
1891.....	34·47	33·76	34·76	1891.....	20·42	19·49	17·42
1894.....	30·45	32·93	35·29	1894.....	17·85	16·42	24·85
1897.....	33·08	24·37	26·80	1897.....	21·40	20·17	16·97
1900.....	25·24	28·91	26·52	1900.....	15·93	—	—
1903.....	27·03	—	—	1903.....	—	—	—
Mean	34·13	34·70	32·29	Mean	19·12	19·49	19·15
General Mean.....	33·17			General Mean.....	19·25		

V. RAULIN.

Montfaucon d'Argonne, 18th June, 1903.

LAKE MOVEMENTS AND THUNDERSTORMS.

SEVERAL New Zealand newspapers recorded that the inland lake Taupo, on February 14th, rose one foot before a thunderstorm and fell again to its normal height after the storm was over. The lake, which has an area of 241 square miles, is the basin of an old volcanic crater. It is a pity that other observations are not available, for the rising and falling may have only been at one end of the lake, and not due in any way to electrical or subterranean causes. Still the matter seems to be worthy of investigation.

D.C.B.

[The relation of the lake levels to meteorological conditions is, we understand, being carried out at present on Loch Ness, in Scotland, by Sir John Murray and his assistants, and we hope to be able, before very long, to publish some description of the methods used and the results which have been obtained.—ED. *S.M.M.*]

THE KEW OBSERVATORY.

THE members of the Council of the Royal Meteorological Society on Wednesday, June 8th, paid a visit to the Kew Observatory, on the invitation of Dr. R. T. Glazebrook, F.R.S. and Dr. C. Chree, F.R.S. Several ladies accompanied the party, and the afternoon being fine a very pleasant time was spent in inspecting the various departments, and in listening to the descriptions of the instruments courteously given by the members of the staff.

Kew Observatory is in the Old Deer Park, about 1,200 yards from Richmond Railway Station. The building, which stands on the site originally occupied by an old monastery, was erected by King George III., in 1769, for observing the transit of Venus. The late Mr. J. P. Gassiot, about 1871, put in trust with the Royal Society an endowment of £10,000 for the purposes of the Observatory, which had been for some time carried on by the British Association; and the management since that time has been in the hands of the Kew Committee appointed by the Royal Society. From 1900 the Observatory has formed part of the National Physical Laboratory, the headquarters of which, however, in 1902 were transferred to Bushy House, Teddington. Dr. C. Chree, F.R.S., is the Superintendent, and the staff includes Mr. T. W. Baker, the first assistant, and 15 others.

The Observatory since 1867 has been the central observing station of the Meteorological Office.

The self-recording magnetic instruments for showing the variations in the declination, the horizontal force component, and the vertical force component, as well as the barograph and the seismograph, are in a room in the basement. These all record photographically. The thermograph is placed on the north wall of the first floor, and the electrograph is close by on the west wall. The Beckley anemograph, for showing the direction and the velocity of the wind, is mounted above the dome, the recording apparatus being in a room underneath. A Dine's pressure tube anemometer is also placed close by. Two Campbell-Stoke's sunshine recorders are on the parapet of the roof.

In the garden to the south of the Observatory are placed the various out-door instruments, including the Beckley self-recording rain gauge, and a Nipher rain gauge.

Apart from the ordinary observatory work, the Kew Observatory is specially devoted to the examination and verification of meteorological and other instruments; and the visitors were much interested in seeing the methods employed and the apparatus used for this purpose. The great extent and variety of this important work will be gathered from the following list of instruments examined last year:—

Air-meters	24	Rain-measuring Glasses	131
Anemometers	14	Sextants	901
Aneroids... ..	86	Sunshine Recorders	6
Artificial Horizons	21	Telescopes	3180
Barometers	298	Theodolites	23
Binoculars	1048	Thermometers, Clinical	19393
Compasses	9	" Meteorological	2851
Hydrometers	353	" Special	389
Inclinometers	8	Unifilars	5
Levels	16	Watches and Chronometers	458
Magnets	15	Miscellaneous	35
Milk Test Apparatus	89		
Rain Gauges	67	Total	29,420

ROYAL METEOROLOGICAL SOCIETY.

THE final Meeting of the present session was held on the afternoon of Wednesday, June 15th, at the Society's Rooms, 70, Victoria-street, Westminster, Captain D. Wilson-Barker, President, in the chair. Mr. F. W. FitzSimons, F.Z.S., and Mr. G. W. Bernini Palmer were elected Fellows.

The Rev. C. F. Box gave an account of some curious "Effects of a Lightning Stroke at Earl's Fee, Bowers Gifford, Essex, April 13th, 1904." A thunderstorm occurred during the early morning hours, and at about 3 a.m. there was a blinding flash, lighting up the whole neighbourhood for miles around, followed immediately by a crashing explosion. One person stated that he saw what appeared to be a cylinder, and another person, a ball of fire, descend and then explode, 'casting darts' in all directions. On careful examination in daylight it was found that in an oat field, which had recently been dredged, there were three distinct sets of holes ranging from nine inches down to about one inch in diameter. The holes, which were circular, diminished in size as they went downwards, and remained so on to the perfectly rounded ends at the bottom. Upon digging sectionally into the soil, which is stiff, yellow clay, it was found that the holes were "as clean cut as though bored with an auger."

Mr. W. Marriott said that the thunderstorm at Earl's Fee formed part of a series of thunderstorms which occurred over the south-eastern and eastern districts on the early morning of April 13th. The storm burst over the south coast at 2 a.m., and reached Lowestoft about 5 a.m., the rate of travel being about 50 miles an hour. Mr. Marriott showed some lantern slides illustrating various types of lightning flashes, and said that with moving cameras it was often found that there were several flashes on the plate following precisely similar courses. He pointed out that the flickering or repeating character of the lightning so frequently observed was really due to a succession of flashes following the same path. It might be that the three sets of holes mentioned by Mr. Box were caused by repeating lightning of three flashes with a slight distance between them. He was also of opinion that if the soil had been of a sandy nature instead of clay, the sand would have been fused and "fulgarites" formed.

Mr. R. Inwards said that it would have been interesting if a plaster cast of the holes had been taken.

Mr. A. Hands remarked that this was a type of case not often investigated, as attention was more frequently paid to buildings damaged by lightning. He believed that instances of damage by lightning were more numerous in Essex than in any other county except Yorkshire.

Mr. R. G. K. Lempfert, on behalf of Dr. W. N. Shaw, exhibited the records from the Dines sensitive barographs in London and at Oxshott during the thunderstorm on April 13th.

The President stated that he had recently seen a house which had

been struck by lightning in the neighbourhood of Greenhithe. The lightning had cut a clean hole through the tiles of the roof, and passing to the ground had gone out at the open door.

A paper by Mr. A. Lawrence Rotch, of the Blue Hill Observatory, U.S.A., describing "an Instrument for determining the true Direction and Velocity of the Wind at Sea," was, in the absence of the Author, read by the Secretary.

THE SIX MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—June, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	10·44	109	Arncliffe	31·86	119	Braemar	12·85	90
Tenterden	13·02	117	Hull	9·48	91	Aberdeen	14·93	112
Hartley Wintney	13·01	123	Newcastle.....	12·28	117	Cawdor	11·02	89
Hitchin	9·62	100	Seathwaite ...	65·01	112	Glencarron ...	43·06	107
Winslow	11·19	114	Cardiff	21·08	133	Dunrobin	14·52	110
Westley	9·90	96	Haverfordwest	22·08	124	Killarney	26·38	112
Brundall.....	9·95	98	Gogerddan ...	20·22	113	Waterford ...	21·06	125
Alderbury	15·19	130	Llandudno ...	13·06	109	Broadford.....	18·40	129
Ashburton	28·86	133	Dumfries	19·61	103	Carlow	15·99	109
Polapit Tamar ...	22·19	148	Lilliesleaf	16·29	128	Dublin	12·83	110
Stroud	14·01	121	Colmonell	18·11	96	Mullingar.....	18·11	114
Woolstaston	13·86	110	Glasgow	16·99	110	Ballinasloe ...	18·61	119
Boston	8·96	106	Inveraray	33·85	108	Clifden	41·04	119
Hesley Hall	9·39	107	Islay	22·87	120	Crossmolina ...	29·98	132
Derby.....	10·43	105	Mull	30·40	126	Seaforde	17·55	110
Bolton	16·75	100	Loch Leven ...	17·01	111	Londonderry..	17·09	99
Wetherby	14·43	141	Dundee	12·55	107	Omagh	20·34	123

June proved to be a dry month in almost all parts of the British Isles, the average deficiency of rainfall over England and Ireland being about one inch, and over Scotland about half-an-inch. A few stations on the west coast showed small excesses, but on the whole it was the driest June for several years; in the south-east of England certainly the driest since 1895. The rainfall for the year in the extreme east of England is no longer above the ten years' average employed for this Table, and excesses above 25 per cent. are confined to the south-west of England, the south of Ireland, and one or two scattered patches which are probably very small. The contrast with June, 1903, is marked, both as regards the rainfall for the month itself in the south of England, and the aggregate rainfall in most places. In Devonshire, however, the first half of 1904 has proved wetter than the first half of 1903. The number of rainy days appears to have been greater in June, 1904, than in the corresponding month of 1903, but this year there has been an unusual absence of thunderstorms.

RAINFALL AND TEMPERATURE, JUNE, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.]	RAINFALL.					Days on which >1 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours.		Max.		Min.		Shade	Grass		
				Depth	Date.			Deg.	Date.			Deg.	Date.
I.	London (Camden Square) ...	.84	- 1.06	.26	14	6	76.7	30	43.1	4	0	0
II.	Tenterden.....	1.64	- .55	.66	9	10	75.0	30	44.0	26	0	0	
III.	Hartley Wintney .....	.79	- 1.16	.25	1	7	79.0	30	42.0	27, 28	0	0
..	Hitchin ..	.86	- .92	...	...	...	...	...	...	...	...	...
..	Winslow (Addington) .....	.60	- 1.25	.23	14	8	79.0	30	39.0	28	0	0
IV.	Bury St. Edmunds (Westley) ..	.81	- 1.23	.26	14	6	75.0	14	40.0	26	0	...	
..	Brundall .....	.68	- 1.34	.25	14	9	75.6	14	39.8	13	0	0
V.	Alderbury .....	.87	- 1.10	.25	1	8	71.0	23, 30	41.0	27	0	...
..	Winterborne Steepleton ...	1.31	...	.30	14	9	70.0	4	36.9	10	0	0
..	Torquay (Cary Green)	1.11	...	.40	14	8	70.1	30	44.5	10	0	0
..	Polapit Tamar [Launceston]	1.31	- 1.08	.42	14	12	69.2	4, 5	35.5	10	0	...	
..	Bath	1.46	...	.53	1	8	74.2	30	41.2	27	0	...
VI.	Stroud (Upfield)	1.18	- .82	.48	14	9	78.0	30	47.0	3	0	...	
..	Church Stretton (Woolstaston)	1.17	- .97	.40	1	11	72.0	29, 30	41.5	6	0	...	
..	Bromsgrove (Stoke Reformatory)	.61	- .89	.33	1	6	75.0	30	35.0	26	0	...	
VII.	Boston	1.55	- .13	.45	2	7	77.0	30	41.0	27	0	...	
..	Bawtry (Hesley Hall) .....	.34	- 1.33	.12	9	5	77.0	29	34.0	28	0	...
..	Derby (Midland Railway)...	.53	- 1.52	.27	24	7	80.0	29, 30	40.0	27	0	...	
VIII.	Bolton (The Park)	1.42	- 2.18	.35	13	12	73.1	30	42.0	2	0	0	
IX.	Wetherby (Ribston Hall) ...	1.57	- .52	.40	26	10	...	...	...	...	...	...
..	Arncliffe Vicarage	2.20	- 1.53	.40	16	11	...	...	...	...	...	...
..	Hull (Pearson Park) .....	.75	- 1.22	.23	9	10	72.0	29	41.0	4	0	0
X.	Newcastle (Town Moor) ...	2.11	+ .23	1.35	24	12	...	...	...	...	...	...
..	Borrowdale (Seathwaite) ...	4.39	- 2.71	1.10	14	13	78.5	5	40.4	8	0	...	
XI.	Cardiff (Ely)	1.45	- .88	.67	14	8	...	...	...	...	...	...
..	Haverfordwest (High St.)...	2.93	+ .60	.90	12	10	72.6	6	40.5	22	0	0	
..	Aberystwith (Gogerddan)...	2.19	- .45	.70	1	7	84.0	5	35.0	27	0	...	
..	Llandudno	1.93	- .04	1.00	1	8	76.0	29	45.8	3, 28	0	...	
XII.	Cargen [Dumfries]	2.36	- .36	.72	24	9	77.2	5	40.0	27	0	...	
XIII.	Edinburgh (Royal Observy.)	2.12	...	.73	1	12	72.8	30	41.3	28	0	0
XIV.	Colmonell	1.92	- .75	.74	14	11	76.0	6	38.0	26, 27	0	...	
XV.	Tighnabruach	2.85	...	.78	14	12	71.0	5	40.0	26, 27	0	0
..	Mull (Quinish)	3.84	+ .41	.62	13	15	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1.77	- .61	.31	14, 25	9	...	...	...	...	...	...
..	Dundee (Eastern Necropolis)	.50	- 1.33	.10	13, 14	11	72.6	3	39.5	11	0	...	
XVII.	Braemar	1.51	- .82	.31	16	11	75.0	3	37.5	28	0	3	
..	Aberdeen (Cranford) .....	.91	- 1.23	.25	23	13	69.0	3	37.0	6	0	...
..	Cawdor (Budgate)	1.50	- .82	.78	1	12	...	...	...	...	...	...
XVIII.	Glencarron Lodge	5.97	+ .23	2.31	16	16	73.0	30	39.6	28	0	...	
..	Bendamph	5.83	+ 1.93	1.86	16	15	...	...	...	...	...	...
XIX.	Dunrobin Castle	1.28	- .76	.30	1	12	65.0	15	38.5	28	0	...	
..	Castletown	1.22	...	.26	23	15	73.0	4, 15	33.0	27, 28	0	...
XX.	Killarney	2.23	- 1.41	.50	15	10	77.0	6, 7	43.0	10	0	...	
..	Waterford (Brook Lodge)...	2.52	- .09	.84	12	8	69.0	5, 6	43.0	3	0	0	
..	Broadford (Hurdlestown) ...	2.01	- .40	.28	30	14	74.0	6	45.0	16	0	...	
XXI.	Carlow (Browne's Hill)	1.40	- .87	.30	14	10	...	...	...	...	...	...
..	Dublin (Fitz William Square)	1.08	- .84	.25	9	10	72.0	30	45.1	27	0	0	
XXII.	Ballinasloe	1.65	- 1.00	.61	14	14	77.0	5	42.0	23	0	...	
..	Clifden (Kylemore House)...	5.48	+ .05	1.55	14	13	...	...	...	...	...	...
XXIII.	Seaforde	2.18	- .38	.66	9	12	86.0	4, 5	43.0	1, 2	0	0	
..	Londonderry (Creggan Res.)	1.10	- 2.04	.34	14	9	...	...	...	...	...	...
..	Omagh (Edenfel)	1.85	- 1.16	.56	14	11	78.0	5	35.0	26	0	1	

+ Shows that the fall was above the average ; - that it was below it.

SUPPLEMENTARY RAINFALL, JUNE, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	·64	XI.	New Radnor, Ednol	1·07
„	Sheppey, Leysdown	1·31	„	Rhayader, Nantgwilt	2·06
„	Hailsham	·98	„	Lake Vyrnwy	1·80
„	Crowborough	1·27	„	Ruthin, Plâs Drâw.....	1·29
„	Ryde, Beldornie Tower.....	·88	„	Criccieth, Talarvor.....	1·32
„	Emsworth, Redlands.....	1·25	„	Anglesey, Lligwy	1·07
„	Alton, Ashdell	·98	„	Douglas, Woodville	1·65
„	Newbury, Welford Park ...	·93	XII.	Stoneykirk, Ardwell House	2·19
III.	Harrow Weald	·90	„	Dalry, Old Garroch	2·71
„	Oxford, Magdalen College..	·75	„	Langholm, Drove Road.....	3·84
„	Banbury, Bloxham... ..	·56	„	Moniaive, Maxwellton House	2·39
„	Pitsford, Sedgebrook	·52	„	Lilliesleaf, Riddell	2·73
„	Huntingdon, Brampton.....	·61	XIII.	N. Esk Reservoir [Penicuik]	2·80
„	Wisbech, Bank House	·52	XIV.	Maybole, Knockdon Farm..	1·80
IV.	Southend	1·12	„	Glasgow, Queen's Park	1·35
„	Colchester, Lexden.....	·87	XV.	Inveraray, Newtown	3·35
„	Saffron Waldon, Newport..	1·05	„	Ballachulish, Ardsheal	4·80
„	Rendlesham Hall	·52	„	Campbeltown, Redknowe...	1·34
„	Swaffham	·67	„	Islay, Eallabus	1·64
„	Blakeney	·70	XVI.	Dollar	1·06
V.	Bishop's Camings	1·00	„	Balquhider, Stronvar	4·57
„	Ashburton, Druid House ...	1·75	„	Coupar Angus Station	·86
„	Okehampton, Oaklands.....	1·29	„	Blair Atholl.....	1·97
„	Hartland Abbey	1·12	„	Montrose, Sunnyside.....	·53
„	Lynmouth, Rock House	1·17	XVII.	Alford, Lynturk Manse ...	·95
„	Probus, Lamellyn	1·93	„	Keith, H. R. S.....	1·64
„	Wellington, The Avenue ...	·88	XVIII.	Fearn, Lower Pitkerrie.....	·83
„	North Cadbury Rectory ..	·70	„	S. Uist, Askernish	2·58
VI.	Clifton, Pembroke Road ..	1·92	„	Invergarry	3·61
„	Moreton-in-Marsh, Longboro'	1·11	„	Aviemore, Alvie Manse.....	1·42
„	Ross, The Graig	·97	„	Loch Ness, Drumnadrochit.	1·95
„	Shifnal, Hatton Grange.....	·69	XIX.	Invershin	1·17
„	Wem Rectory	1·02	„	Altnaharra .....	...
„	Cheadle, The Heath House.	·96	„	Bettyhill	·95
„	Coventry, Kingswood	·41	„	Watten, H. R. S.	1·30
VII.	Market Overton	·58	XX.	Cork, Wellesley Terrace ...	2·17
„	Market Rasen	·30	„	Darrynane Abbey	5·28
„	Worksop, Hodsock Priory..	·37	„	Glenam [Clonmel]	3·02
VIII.	Neston, Hinderton.....	2·09	„	Ballingarry, Hazelfort	1·49
„	Southport, Hesketh Park... 1·12		„	Miltown Malbay.....	1·68
„	Chatburn, Middlewood	1·29	XXI.	Gorey, Courtown House ...	2·01
„	Duddon Valley, Seathwaite Vic.	3·12	„	Moynalty, Westland .....	...
IX.	Langsett Moor, Up. Midhope	·89	„	Athlone, Twyford	1·72
„	Baldersby	1·35	„	Mullingar, Belvedere.....	1·34
„	Scalby, Silverdale	1·00	XXII.	Woodlawn	1·50
„	Ingleby Greenhow Vicarage	1·50	„	Westport, Murrisk Abbey..	2·82
„	Middleton, Mickleton	1·53	„	Crossmolina, Enniscoe	3·02
X.	Beltingham	1·12	„	Collooney, Markree Obsy... 1·85	
„	Bamburgh.....	2·12	XXIII.	Enniskillen, Portora	1·66
„	Keswick, The Bank	2·10	„	Wafrenpoint	1·49
„	Melmerby Rectory.....	1·74	„	Banbridge, Milltown	1·41
XI.	Llanfrecfha Grange	1·50	„	Belfast, Springfield	1·35
„	Treherbert, Tyn-y-waun ...	2·86	„	Bushmills, Dundarave	1·01
„	Llandoverly, Tonn	1·77	„	Stewartstown	1·40
„	Castle Malgwyn	2·33	„	Killybegs	1·39
„	Llandefaelog-fach	1·26	„	Horn Head	1·04

METEOROLOGICAL NOTES ON JUNE, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm. R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The weather was somewhat cloudy and lacking in sunshine, but dry and generally fine. It was the driest June for nine years. The temp. kept at an uncomfortably low point at times, especially during the first week, and on only three days during the month did the max. exceed 75° . The duration of sunshine was $158^{\circ}7^{*}$ hours, and of R $16\cdot7$ hours. Mean temp. $58^{\circ}9$, or $1^{\circ}5$ below the average. No TSS.

ABINGER HALL.—Very dry, with a good deal of cold N. and N.W. wind, and several slight frosts towards the end. Splendid hay-time and good crops.

TENTERDEN.—East wind in the first part damaged the fruit. There was a fair amount of sunshine, $230\cdot5^{\dagger}$ hours, but only 8 days with max. temp. above 70° . TS on 6th.

CROWBOROUGH.—A beautiful summer month, with considerable sunshine and deficient R. Mean temp., $55^{\circ}6$.

HARTLEY WINTNEY.—Persistent cold N. and N.E. wind and fitful sunshine marked the first fortnight. The second fortnight was exceedingly dry, and the last week summerlike. Ozone on 14 days with a mean of $2\cdot1$. Hay crops good.

PITSFORD.—A beautifully fine warm month. R $1\cdot42$ in. below the average. Mean temp., $56^{\circ}8$.

COLCHESTER.—Cool and very dry, with many bright days, and excellent weather for hay harvest.

BLAKENEY.—R $1\cdot17$ in. below the average of 10 years. Heavy storms occurred some few miles away, but none reached here, although T was often heard.

TORQUAY, CARY GREEN.—R $1\cdot09$ in. below the average. Duration of sunshine, $240\cdot1$ hours, or $9\cdot5^{*}$ hours above the average. Mean temp. $57^{\circ}7$, or $1\cdot0$ below the average. Mean amount of ozone, $5^{\circ}1$.

WELLINGTON.—Pleasant weather, with very little R and much bright sunshine, though the temp. was rather low, only 5 days having a max. of 70° or above. R an inch below the normal.

NORTH CADBURY RECTORY.—Very dry but not hot, with many rather low maxima and some cold nights. Hardly a day without very perceptible wind.

CLIFTON.—After a very wet and cold day on the 1st, it was fine on the whole till the 12th. Thereafter alternate rainy and fine spells of a few days continued until the end. Fine and warm from 27th to 30th.

ROSS.—The R was less than half the average, and there were no days with heavy falls, and only three with more than $\cdot07$ in. The mean temp. was rather more than a degree below the average. The nights were frequently very cold. and on no day did the max. reach 80° .

WORKSOP.—The driest June for at least 30 years, except 1887.

BOLTON.—The driest June since 1889. The duration of sunshine was $179\cdot8$ hours, or $19\cdot0$ hours above the average. Mean temp. $53^{\circ}8$, or $2^{\circ}2$ below the average, and the lowest since 1892. T and L on 24th. Much of the hay had already been secured in fine condition by the end of the month, and cereals promise to yield good crops.

SOUTHPORT.—Exceptionally windy; dry, but rather cool. Mean temp. $1^{\circ}2$ below the average. Duration of sunshine 9^{*} hours above the average. R $1\cdot10$ in. below the average.

HULL.—Generally mild, with some bright warm days. Cold nights until 12th, but afterwards warm. T and L on 26th.

* Campbell-Stokes.

† Jordan

LLANDOVERY.—A fine month, but cool, and very similar to June, 1903, the mean temp., $56^{\circ}\cdot4$, being the same. Grass crops were remarkably good and well harvested.

HAVERFORDWEST.—Fine and warm, but without any high temp. From 12th to 17th was wet and stormy, with a strong gale beginning on the 14th, and doing some damage. Duration of sunshine, $230\cdot6^*$ hours. No TSS. Crops of all kinds looking well, but backward.

DOUGLAS.—The fourth successive month of persistently low temp., but sunshine was not deficient as in the three previous months. Spring flowers were in bloom at the month's end. Mean temp. $0^{\circ}\cdot8$ below the average.

SCOTLAND.

CARGEN [DUMFRIES].—Fine genial weather during the first half, but the latter part was wet, cold and squally. T and L on 24th. Great promise of fruit and farm crops.

LANGHOLM.—The R was $\cdot48$ in. above the average of 28 years, and $1\cdot57$ in. above that for June, 1903. TS on 24th.

MAXWELTON HOUSE.—Fine as a whole. R $\cdot46$ in. below the average. Mean temp. 57° , being equal to the average.

LILLIESLEAF, RIDDELL.—R $\cdot76$ in. above the average. The weather was quite satisfactory for agricultural purposes, and there was grass in abundance.

INVERARAY.—Both the beginning and end were fine and warm, but the season was somewhat late.

MULL, QUINISH.—Abundant sunshine and an excellent prospect for fruit and crops. The week beginning on 13th was exceptionally stormy.

COUPAR ANGUS.—The month opened bright and warm, but cold and stormy N.W. winds, more like March than June, predominated till 27th, and the month closed bright and warm.

LYNTERK MANSE.—The first instance in 4 years of a month with less than an inch of R.

DRUMNADROCHIT.—R $\cdot18$ in., and rainy days 1, below the average of 18 years.

BETTYHILL.—Bright dry weather with scarcely any R.

WATTEN.—Dry and fine, though often cloudy and windy.

CASTLETOWN.—The first twelve days were very dry, with light wind and high bar. Strong westerly winds to 22nd with R and overcast skies. The latter part was changeable, but cold N. and S.E. winds. Slight frost on 28th.

IRELAND.

CORK.—Mean temp. $4^{\circ}\cdot3$, and R $\cdot62$ in., below the average. Prevailing winds E. and W.

DARRYNANE ABBEY.—R 55 per cent. above the average, the excess being due entirely to an exceptional fall of $2\cdot79$ in. on 28th, most of which fell after 8 p.m. A gale on 15th and 16th damaged the potato crops in exposed places. On the whole it was a fairly fine month, with some very fine and hot days, especially in the first half.

BROADFORD, HURDLESTOWN.—A favourable June. Crops of all kinds doing well.

MILTOWN MALBAY.—An ungenial June. Rather cold with dry winds. Little R, though 15 rainy days. Only two real summer days.

DUBLIN.—A favourable month, with average temp. by day and night. Bright sunshine $242\cdot3$ hours, being 45 hours above the Phoenix Park average.

BANBRIDGE.—R $\cdot89$ in. below the average of 40 years.

BELFAST.—A most encouraging June, the finest since 1893, and the finest month since March, 1900. Crops promising excellently.

OMAGH.—It is long since there has been so summerlike and agreeable a June, or one in which the resulting softness of foliage and profusion of flowers have lent more beauty to the landscape. Early fruits were most abundant, and later ones promise equally well.

Climatological Table for the British Empire, January, 1904.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
London, Camden Square	55·3	13	25·1	1	44·1	34·8	37·8	93	65·1	19·8	2·33	22	7·8
Malta	69·1	23	42·1	21	59·7	48·8	47·5	81	107·4	39·0	3·63	18	5·9
Lagos, W. Africa	89·0	sev.	66·0	10	87·0	74·1	74·2	77	136·0	63·0	1·85	3	3·7
Cape Town	100·5	23	50·6	27	78·5	60·0	56·8	65	...	...	·34	4	1·6
Durban, Natal	94·5	15	62·8	31	85·4	68·8	...	...	148·3	...	4·11	14	6·1
Mauritius	89·3	8	67·6	19	85·4	71·7	68·8	75	153·0	64·0	3·36	23	6·8
Calcutta	83·4	18	48·6	8	78·3	54·3	53·4	64	136·2	41·1	·00	0	0·7
Bombay	87·9	7	62·3	19	83·7	69·1	64·7	69	136·4	56·9	·00	0	1·0
Madras	84·8	27	61·8	31	83·0	69·2	67·5	78	138·1	56·5	1·00	3	4·0
Kodaikanal	72·1	31	39·9	7	62·1	46·2	38·4	61	135·4	28·0	3·39	4	4·8
Colombo, Ceylon	91·0	7	68·3	31	83·5	72·0	68·9	78	157·7	67·0	5·74	16	6·4
Hongkong	74·9	14	44·9	20	64·9	55·4	50·9	72	126·1	...	·12	2	4·9
Melbourne	94·2	9	48·1	27	74·9	57·0	54·8	72	151·2	41·0	5·68	14	5·6
Adelaide	100·3	8	46·9	21	81·3	58·8	50·9	51	154·5	37·9	2·53	8	3·2
Coolgardie	107·2	16	48·6	4	92·3	60·4	50·0	39	174·6	46·5	·01	1	0·8
Sydney	96·8	26	58·5	26	77·4	64·6	59·8	67	134·9	45·0	1·93	17	4·8
Wellington	82·3	21	46·1	9	71·1	54·0	51·9	50	135·0	41·0	1·50	10	5·1
Auckland	78·0	12	49·5	9	73·2	59·7	59·3	78	148·0	46·0	·82	8	5·0
Jamaica, Negril Point	87·8	22	63·8	7	84·9	69·1	67·5	74	...	...	1·42	5	...
Trinidad	89·0	16	62·0	22	85·2	67·9	70·1	60	160·0	61·0	3·00	17	...
Grenada	84·8	1	69·6	24	81·3	71·9	70·0	74	150·0	...	5·62	22	3·2
Toronto	40·2	22	-15·1	4	24·3	7·6	15·5	85	59·8	-18·2	2·39	18	7·0
Fredericton	41·9	14	-27·5	4	19·1	-3·6	-4·5	59	...	...	3·40	9	6·4
Winnipeg	36·1	7	42·0	24	7·4	-13·4	...	...	...	...	·17	4	3·7
Victoria, B.C.	55·1	12	27·7	19	45·0	37·6	...	...	...	...	4·32	23	8·8
Dawson	20·0	6	-57·8	14	-16·1	-26·4	...	...	...	...	·82	8	5·8

MALTA.—Mean temp. of air 54°·1 or 0°·9 above, mean hourly velocity of wind 10·5 or 0·7 below, averages. Mean temp. of sea 60°·0. TSS on 26th.

Mauritius.—Mean temp. of air 1°·3, dew point 1°·3, and R 3·74 in., below averages. Mean hourly velocity of wind 10·4 miles, or 0·7 below average; mean direction E.

MADRAS.—Bright sunshine 209·2 hours.

KODAIKANAL.—Mean temp. of air 52°·4. Mean velocity of wind 317 miles per day. Bright sunshine 185·8 hours.

COLOMBO, CEYLON.—Mean temp. of air 77°·6 or 1°·5 below, of dew point 1°·1 below, and R 5·74 in. or 2·17 in. above, averages. Mean hourly velocity of wind 11·3 miles, prevailing direction N. TSS on 8 days.

HONGKONG.—Mean temp. of air 59°·5. Bright sunshine 185·2 hours. Mean hourly velocity of wind 13·8 miles; mean direction E. by N.

Adelaide.—Mean temp. of air 4°·1 below, and R 1·39 in. above, average.

Sydney.—Mean temp. of air 0°·5, humidity 4 %, and R 1·63 in. below, averages.

Wellington.—Mean temp. 3°·0 above, and R ·91 in. below, averages; prevailing winds, N.W. and S.

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THE WETTEST PLACE IN WALES,

With some Remarks on the Rainfall of the Year 1903.

By J. R. GETHIN-JONES, Deganwy, Llandudno.

ON looking at a good physical map of the country it is natural to expect that the wettest part of Wales would be found in the Snowdon district, and according to my investigations I find it to be on the eastern side of this mountain at 2500 feet elevation, near Glaslyn Lake. Although the records show, so far, that Snowdon will likely prove to be the wettest spot in the British Isles, I must, owing to the shortness of the period of investigation, apply the phrase, the "wettest spot," to Wales only for the present.

Having been born and lived all my life in Snowdonia, and always taken a deep interest in the physiography of my native surroundings, I saw in the great advancement of electrical science during recent years the possibility of utilizing the natural forces on the Snowdonian range. In order to get a proper idea of the amount of water available, I fixed rain gauges at several places on the range where I thought it would be most suitable to produce a cheap and large constant supply of power. There was another important point which always impressed me—viz., the desirability of knowing the actual rainfall in the heart of this interesting mountain, the surroundings and contour of which appeared exceptionally favourable to produce a high precipitation.

Having often read that certain places in Cumberland recorded the highest rainfall in the British Isles, being nearly double the highest recorded in Wales, and on comparing the surroundings and contour of Snowdon with those of Sca Fell and the Styne, in Cumberland, the more I studied the maps, the more convinced I became that the eastern side of Snowdon—called Cwm Llydaw—ought theoretically to prove as wet as The Styne. As I had previously observed at other places on the range that the greatest rainfall occurs between half-a-mile and a mile from the summit of the hills in line with the most prevalent moisture-bearing winds—the S.W.—on its sheltered side, I fixed a rain gauge of large capacity at a place in Cwm Llydaw called Glaslyn, situated one mile N.E. and 1000 feet below the

summit, in order to record the effect of the maximum condensation on the prevailing wind after passing the highest point.

On examining a good map, such as the one-inch Ordnance Map, it will also be seen that the cwm forming the eastern side of Snowdon is surrounded by ridges over 3000 feet in average height, in the form of a horse shoe, with the outlet or mouth facing the east, or the driest point. The contour of this cwm therefore acts as the sheltered side for the wind blowing from *all the wettest points*—viz., S. by W. to N. Thus the general effect of the condensed moisture, after passing over the ridges, meets in a focus at this cwm, accompanying rainstorms from all the wet points and all wind velocities except (according to my observations on the range) the very high velocities, during the prevalence of which the heaviest precipitation is carried forward a few miles beyond its base. The rule I always find at Snowdon and other places is, that the greater the wind velocity, the further away from the summit will the greatest precipitation take place; but as the frequency of rain with very high wind is small compared to the rest, the great bulk of the Snowdon condensation falls on its own slopes.

Besides the favourable contour of Cwm Llydaw, it will also be seen on the map that Snowdon is situated not only near the western sea coast with steep slopes, but that there are five comparatively low level valleys radiating from its base towards the sea and the wet points, along which the lower strata of the atmosphere is conveyed direct to its base under the most favourable conditions to retain moisture, and is then carried up *steep* slopes and over ridges 3000 ft. high, with the result that the maximum contained moisture is suddenly condensed or the sea level conditions suddenly changed to the discharging point by a vertical lift of 3000 feet and precipitated in a short horizontal distance, which in the case of Snowdon is in the nearest area contained within the surrounding ridges—viz., Cwm Llydaw.

Everybody is aware of the great prevalence of mist at Snowdon, the cause of which can be assumed to be the same as that of rainfall. According to my general observations on the range, I find that the yearly rainfall at different places coincides very remarkably with the height of the mist line—that is, the lower the average elevation of the mist line, the higher will be the average rainfall, and *vice versa*.

Regarding the rainfall at the "Wettest place in Wales" for such a wet year as 1903, I am sorry to state that, owing to my being laid up at the end of 1902, when the gauges should have been emptied in readiness for 1903, and only myself knowing where to find them on the ground, I am unable to give the actual measurement for more than seven months of the year—viz., from May 21st to the end of December; but with the seven months' records and those of two other places in the vicinity where the conditions are most like those of Snowdon having a full year's record—viz., Oakley, Blaenau Fes-

tiniog, and Tynddol, Dolwyddelen—I will try to give an estimate for the whole year at the wettest spot.

The Glaslyn gauge (supposed to represent the wettest spot at Snowdon) is situated on a flat piece of ground, covered mainly with grass, one mile N.E. of the summit, near Glaslyn Lake, at 2500 feet elevation. It is 5 inches in diameter, with a long neck and special form in the lower part, so as to hold a large quantity, about 130 inches; sunk well into the ground to prevent the water from freezing. About half-a-mile S.E. of this gauge and 1000 feet lower down, near Llydaw Lake, there is another gauge of similar form. The Glaslyn gauge was fixed on September 1st, 1898, and the amount of rainfall measured from it and the surrounding gauges during the same period was as follows:—

PERIODS.	SNOWDON.		Oakley. B. Festiniog 7 miles S.E. of Snowdon. 1100 ft.	Tynddol Dolwyddelen 5 miles E.S.E. of Snowdon. 600 feet.
	Glaslyn Gauge. 2500 feet. inches.	Llydaw Gauge. 1450 feet. inches.	inches.	inches.
From September 1st, 1898, to September 30th, 1899 = 13 successive months	217·33	193·36	109·69	119·42
Average per month.....	16·71	14·87	8·43	9·18
Average per 12 months	200·52	178·44	101·16	110·16
From March 1st, 1900, to De- cember 31st, 1901 = 22 suc- cessive months	365·80	331·00	170·29	189·90
Average per month.....	16·60	15·00	7·73	8·63
Average per 12 months	199·20	180·00	92·76	103·56
Result of the two periods = } 35 successive months	583·13	524·36	279·96	309·32
Average per month.....	16·16	14·98	8·0	8·83
Average per 12 months	199·92	179·76	96·0	106·0

It will be noticed that the first period covers one winter and one summer and the second period two summers and practically one winter. The other gauges on Snowdon are omitted owing to unavoidable gaps in the Glaslyn records.

Previous to 1902 the average annual rainfall at Oakley for a long period was about 94 inches, and at Tynddol about 100 inches. On this basis, the average at Glaslyn for a long period would therefore be about 190 inches a year.

The actual rainfall measured at Glaslyn and Llydaw for the seven months, May to December, 1903, was as follows:—

INTERVALS.	Glaslyn gauge. inches.	Llydaw gauge. inches.
From Sept. 30th, 1902, to May 21st, 1903	<i>Full, water emptied</i>	131·34
May 21st, 1903, to Sept. 8th, 1903	60·10	48·30
Sept. 9th, ,,	5·30	...
,, 11th, ,,	4·12	8·46
Oct. 23rd, ,,	30·20	26·60
Jan. 1st, 1904	44·20	37·10
Total for 7 months	143·90	120·46
Total for 15 months (Sep. 30, '02, to Jan. 1, '04)	300·00 (estimate)	251·80 (actual)
Equal for 12 months	240·00	200·40

The rainfall for the last three months of 1902 was about the average, but for the first five months of 1903 it was greatly above the average, so according to this, the total at Glaslyn for the twelve months of 1903 would be considerably above 240 inches.

According to the rainfall at Tynddol for the first 5 months of 1903—equal to 58·55 in.—and the 35 months Glaslyn ratio, the amount at Glaslyn for the same 5 months comes to 110 inches, which with the actual fall of 143·9 in. for the 7 months, makes 254 inches for the whole year at Glaslyn, and according to the same calculation and applying the ratio of Oakley, the total at Glaslyn for the year comes to 246 inches. Also, as the rainfall for 1903 was about 35 per cent. above the average on the whole range, and the average at Glaslyn for a long period is about 190 inches, the net result from the above different estimates gives the rainfall at the wettest spot in Wales for 1903 as at least 250 inches. If this figure is right it seems, as far as I know, to be above the highest ever previously recorded in the British Isles and in Europe. The previous highest was at The Sty, in Cumberland, being 243·98 in. in 1872.

During the autumn of last year I was fortunate to be at Cwm Llydaw, when I experienced very remarkable weather and took the opportunity during the most stormy time to watch the different phenomena.

During a heavy rainstorm, on August 14th, I measured the rate at which the rain fell as ·60 in. per hour, at Llydaw Lake, and higher up, at Glaslyn, as ·75 in. per hour. Considering that it was an ordinary cyclonic rain, this figure seems to be exceptionally high, also the raindrops appeared to me to be of larger size at Glaslyn than those lower down from the effect of their dropping on the lake and the bubbles left behind, giving an appearance as if the water was boiling, the sound from which—a high tone—could be heard quite distinct from that of the wind and the surrounding waterfalls.

When the wind blows over the ridges, the direction of it in the cwm below is very changeable; sometimes it would be quite calm, then sudden squalls, and forming whirlwinds, the track of which could be easily followed on the lakes, especially that of Llydaw; sometimes the parallel vertical rain columns could be seen travelling in reverse directions as if in a circle or following the contour of the cwm, and when the rain would be very thick and during the passing of the whirlwinds there was a tendency for the vertical columns to get closer and form a "solid" waterspout.

On September 9th I noticed that a waterspout had actually been formed during the previous night and burst on the steep slope below Llydaw Lake. It had excavated the ground in a semicircular form to a depth of about 3 feet—rock and boulder bottom—and measuring about 20 feet across, and had carried the material about a quarter of a mile down the hill side. Until lately, I had always been under the impression that such waterspouts were formed above the ridges or among the clouds, especially as the term "cloud-burst" implied something of that nature; but from my observations in Snowdonia, it seems to me that they are formed near the ground and always in the space *below* the ridges over which the wind blows at the time, being the sheltered side, and in places where the ground is in a concave form and the rain very thick; under these conditions, the raindrops are whirled round with the air and come in contact with each other forming a thin water column, and in further travelling through thick rain the whirling draws more rain in contact with the column and therefore grows larger in diameter and length until it has attained a size by which its weight overcomes that of the centrifugal power and then the whole water falls in line with the column, or following the vacuum created in dropping, which I find it *always* does, on a *single spot* a few yards in diameter, and does not burst or get spread about by the wind like a "solid" mass of water thrown out of a bucket during wind from a great height.

While treating on the wettest spot in Wales, and bearing in mind that the most rainy part of England has been so well explored, it seems to me a great pity that the real amount and the position of the highest rainfall in Scotland and Ireland is still unknown, so that it cannot be compared with that of England and Wales. Considering that so much interest is taken in ascertaining the extreme limit of certain things in nature—especially in our own country—and the cheapness and simplicity of work of this kind compared with other scientific explorations, I wish to suggest that something in the nature of a national scientific competition be undertaken by societies or individuals of each of the constituent nations, to ascertain how the countries stand in this matter, and find out the exact place where the greatest number of favourable physical features exist to produce the highest rainfall. It is quite possible that with further exploration in England and Wales, a spot could be found with a higher average than the present records show. Scotland is already

proud of possessing the highest mountain ; Ireland the largest lake ; England the largest river ; and, in my opinion, Wales the finest scenery. The claim of possessing the wettest spot is so far held by England ; but, as a Welshman, I feel with pleasure and am very confident—on scientific grounds—that with further time, Wales will be acknowledged to beat England by at least 20 inches a year. In regard to Ireland the position is rather peculiar. It is generally a wet country, yet one seldom hears of a rainfall exceeding 100 inches a year. Whatever view people take on Irish questions, I am sure that Ireland in this respect is not treated fairly, and it is a question that ought to be solved at once. There are several heights in Ireland over 3,000 ft., and some are situated on the very edge of the Atlantic, viz., Brandon Hill, Kerry, the surroundings of which, apart from its height, seem favourable to produce as high a rainfall as that of Snowdon and The Styne, with a good chance to claim the highest in the British Isles.

Regarding Scotland, the records at the summit of Ben Nevis are, and ought to be, very high ; but I cannot see how the real measurement of moisture at such a high elevation can be accurately gauged, as a large proportion of the moisture must fall in the form of dry snow, which during windy weather—so prevalent at the *summit*—must be mixed with the drifted snow-dust to a height above that of the rain gauge, and even the Observatory itself, and the drift must therefore be collected with the actual snowfall.

If the record at the summit of Ben Nevis represents the true amount of precipitation there—which is practically the same as that of The Styne—viz., about 170 inches, and as the recorded figures at the summit of Scafell, Great Gable and Great End are only half that of The Styne, with the latter place lying to the N. and on the sheltered side of these heights, it seems to me that the sheltered corrie lying to the north of Ben Nevis ought to record considerably over 300 inches, or that the present record at the summit does not represent the true figure. For this reason, I think the records of the wettest spots ought to be taken in the corries where the rainfall is likely to be not only higher, but also more accurately measured.

There are of course very many places in the Western Highlands possessing “points” favourable to the production of high rainfall, especially the Loch Coruisk Valley, Isle of Skye ; the conditions at this place, at the far end of the corrie, look almost ideal to produce the highest rainfall possible for this latitude. Considering the small expense, compared with other explorations, and the addition to our knowledge, to obtain such interesting facts about our own country, I venture to ask, is there not some Scotsman or Irishman who would take this matter in hand and co-operate with English and Welshmen to find out in a thorough and scientific manner which part of the United Kingdom can claim the notoriety of possessing the wettest spot ?

BRITISH RAINFALL, 1903.

WE cannot, of course, profess to give an impartial review of one of our own publications, but there is no reason why the issue of the annual volume* dealing with the rainfall of the British Isles should not be recorded in these pages. The volume now appears under its present title for the forty-third time, but it has grown from a slim pamphlet of 18 pp. to a solid bound book of 368 pp. illustrated with 10 plates and 8 maps and diagrams in the text. The first volume dealt with "about 500 stations," the latest with "nearly 4000." The volume is not published as early as we could wish. This is mainly because a few observers whose records we would be most reluctant to omit cannot be induced to send in their observations ending in December until the month of June. The results cannot be generalised and discussed until they have all been received, checked and compared; hence the delay.

The new volume contains several new features. The two special articles deal with the daily rainfall of June, 1903 (and especially with the three remarkable days from the 13th to the 15th), and with the three wettest years of British rainfall, viz., 1872, 1877 and 1903, of each of which there is a rainfall map. A new section on the duration of rainfall is introduced in Part I. In Part II, in addition to all the old features, there are sections dealing with rainy spells, *i.e.*, periods of more than fourteen consecutive rainy days; with the number of rainy days; and with the intensity of rainfall, classifying the number of daily falls of different amount. The section on monthly rainfall has been made more systematic, and the maps of the relation of the actual monthly rainfall to the average have been greatly improved. A special feature is made of maps of the distribution of rainfall on the wettest days of the year. The number of records dealt with is 3829, which is 193 more than in 1902.

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### WIRELESS TELEGRAPHY AND METEOROLOGY.

WE have great pleasure in recording the public-spirited enterprise of the *Daily Telegraph* in supplementing its usual weather reports by special telegrams from the Atlantic. In its issue of August 6th it states:—"We have arranged with the Marconi Wireless Telegraph Company and the Atlantic steamship companies to send us, from ships homeward bound, telegrams reporting the readings of barometer and thermometer, description of the weather, force of the wind and state of the sea, and from these data we believe it will become possible, in many cases, to give intimation of coming storms

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\* On the Distribution of Rain over the British Isles during the year 1903, as observed at nearly 4000 stations in Great Britain and Ireland. With articles upon various branches of Rainfall work. Compiled by Hugh Robert Mill. London: Edward Stanford, 1904.

that it would otherwise be absurd to attempt. . . . We assert, meanwhile, and every meteorologist will bear us out, that whatever may be the value of existing predictions, it will be doubled when the system we inaugurate to-day is fully developed. At present, ships at sea cannot send messages to the land over more than an average of one hundred miles. This arises simply from the want of sufficiently powerful transmitting apparatus, for the same ships can receive messages for over two thousand miles. Improved equipments are being installed and the time is not far distant when we shall be in receipt of wireless telegrams from mid-Atlantic, and when that day comes it will be rare that any great storm shall rush across these storm-swept islands of which we have not as full notice as can possibly be given."

We trust that the proprietors of the *Daily Telegraph* will not forget that these important telegrams from the Atlantic are of value only in connection with the information received daily by the Meteorological Office from the ordinary reporting stations and that it is at the Meteorological Office alone that they can be utilized and raised above the level of interesting items of information. If published in the newspaper without co-ordination, they will, we fear, prove no more valuable than the *New York Herald* storm warnings of years ago.

#### A HOT DAY IN AUGUST, 1904.

DURING the morning and afternoon of August 4th, the hottest day of 1904 up to August 15th, hourly readings were made of temperature and humidity on the Glaisher screen at Camden Square, with the following results:—

|              | Dry bulb. | Wet bulb. | Shade<br>Max. | Relative<br>Humidity. |
|--------------|-----------|-----------|---------------|-----------------------|
| 9 a.m. ....  | 80·2      | 68·4      | 80·2          | 51                    |
| 10 a.m. .... | 84·8      | 70·2      | 84·8          | 44                    |
| 11 a.m. .... | 87·6      | 72·2      | 88·1          | 43                    |
| Noon ..      | 88·3      | 72·0      | 89·2          | 41                    |
| 1 p.m. ....  | 90·1      | 73·0      | 90·2          | 39                    |
| 2 p.m. ....  | 85·5      | 70·1      | 91·0          | 42                    |
| 3 p.m. ....  | 82·2      | 69·0      | 91·0          | 47                    |
| 4 p.m. ....  | 78·7      | 67·0      | 91·0          | 51                    |
| 5 p.m. ....  | 74·0      | 66·2      | 91·0          | 63                    |
| 9 p.m. ....  | 65·8      | 63·6      | 91·0          | 87                    |

Heavy clouds gathered at about 3 p.m., and ·14 in. of rain fell between 5.30 and 7 p.m., with some distant thunder and lightning. It will be observed that the maximum temperature of 91°·0 occurred between 1 and 2 p.m. The minimum temperature of the preceding night was 59°·2, that of the succeeding night 61°·9. The duration of sunshine on the 4th was 7·5 hours, and the amount of evaporation from a freely exposed water-surface ·16 in.

## THE YORKSHIRE THUNDERSTORM OF JULY 24th.

IN case you should not receive them from elsewhere, I venture to enclose the accounts published in the Huddersfield papers of the exceptional storm of Sunday evening last. My own station, about four miles from the centre of Huddersfield in a S.W. direction, was outside the worst of it, and there was nothing more than an ordinary heavy thunderstorm, except from 8.41 to 8.51 p.m. (for which see Note 4.) Mr. Woodhead, of Slaithwaite, (see newspaper report) is interested in meteorology and keeps a careful record, and he might be able to give you more information as he was in the thick of it. I enclose a few notes, however, which may be of interest.

CHARLES L. BROOK.

(1) Saturday, July 23rd.—Slight TSS all afternoon; heavy rain at Harewood Lodge from 11.56 a.m. to 0.15 p.m.; .28 in. in 19 min. Rainfall for 24 hours ending 9 a.m. on 24th: Harewood Lodge, .82 in.; Royd Edge (about) 1.00 in.

(2) Sunday, July 24th.—On this afternoon I several times noticed that currents of air were moving in two or three different directions at the same time; the upper current from S.S.W. faster than the lower and more intermittent currents, which were from N.E. to S.E. Little rain, however, fell till 7 p.m.

(3) At 7 p.m. commenced a prolonged and at times severe TS, which lasted till 11.30 p.m., during which time there fell at Harewood Lodge 1.19 in. and at Royd Edge .64 in. There was nothing exceptional here in the T and L, but I noticed that to the N. and N.E. some of the flashes were high up, of long duration, and reddish orange in colour; often only the glare from behind the lowest layer of clouds could be seen.

(4) The only really exceptional rainfall was from 8.41 p.m. to 8.51 p.m., when .53 in. fell in ten minutes. At 8.44 p.m. the wind rose very suddenly from the N.W. and blew with almost hurricane force for one or two minutes, during which time the down-pour was so excessive that I have little doubt the rate of fall was double that mentioned above. The wind veered through N. to N.N.E. and it was quite calm before 9 p.m. This was the most sudden and severe squall I recollect and for a few moments I thought some of the trees would go. The barometer did not vary more than .005 during the squall.

(5) The only other rainfall I have recorded which exceeds this was on June 26th, 1895, when 1.13 in. fell in 25 minutes with large hailstones.

(6) Total Rainfall, 24 hours ending 9 a.m. on July 25th :—  
 Royd Edge ..... .85 in. (about).  $\frac{2}{3}$  mile S.W. of Harewood Lodge.  
 Harewood Lodge 1.41 in.  
 Hudd. Cemetery 3.80 in. about 4 miles N.N.E. of Harewood Lodge.  
 Slaithwaite ..... 3.97 in. about 3 miles N.W. of Harewood Lodge.

*Harewood Lodge, Meltham, July 27th, 1904.*

C. L. B.

THE very heavy rainfall on Sunday, July 24th, is, I think, worthy of record in your Magazine.

The total fall for the 24 hours commencing 9 a.m. on that day was 3·97 inches. A fairly heavy thunderstorm commenced about 6 p.m. with one or two very slight showers of rain. Suddenly at 8.10 p.m. it commenced to rain in torrents and continued exactly an hour; the amount of rain during the 60 minutes was 2·36 inches. There was a fine interval of 35 minutes, and then more heavy rain for 1 hour and 20 minutes, when I measured a further 1·33 inches.

JAS. WOODHEAD.

*Inglewood, Slaithwaite, Huddersfield, 1st August, 1904.*

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### RAINFALL OF JULY 23-27.

DR. MILL, in his interesting letter to *The Times* on the thunderstorm of July 25th of the present year says:—"Few years pass without the occurrence of such a storm in the S.E. of England between the 23rd and 27th of July." My own experience, extending over a period of 25 years, is, that there are no other consecutive five days in the whole year which yield a larger aggregate of rain, and this mainly owing to the prevalence of thunder. Since 1880 I have gauged on these five days an aggregate of 17·07 inches, rain falling on 68 days. This gives an average of ·25 inch per rainy day. The analysis of these 68 days on which rain was observed shows that there was a fall of 2·00 in. on one day; 1·00 in. on one day; ·50 in. and more on eight days; and ·25 in. and more on fifteen days. On the other 43 days the fall was inconsiderable. The amount gauged last year and this on these five days was almost identical, being 2·22 in. last year against 2·30 in. this year. Thunderstorms occurred on 25th in 1901; and on 27th in 1901 and 1904; and thunder was in evidence in several other years, though no actual storm passed over my station.

C. WIGAN HARVEY.

*Throcking Rectory, Buntingford, Herts, August 1, 1904.*

The following is the portion of the letter referred to above dealing with the storm of July 25th:—

"The prolonged period of dry weather terminated yesterday with a fine example of a summer thunderstorm. Few years pass without the occurrence of such a storm in the south-east of England between the 23rd and 27th of July; but our knowledge of the distribution of the accompanying heavy rain is still very unsatisfactory. The rainfall day terminating at 9 o'clock this morning brought a fall of 1·71 in. of rain in this locality. In the southern suburbs I hear that not one-third of this amount fell. Perhaps in some districts much more may have been precipitated.

"Speaking for Camden Square alone, yesterday was wetter than any day in last year, and the amount of rain has only been exceeded

in one day five times since the record began in 1858. Those occasions were—July 25, 1867, with 1·82 in.; April 10, 1878, with 2·56 in.; June 23, 1878, with 3·28 in.; December 26, 1886, with 1·82 in.; and July 25, 1901, with 2·85 in. It is a curious point that three out of these six occasions should happen to have been July 25.

“Several gentle showers during the forenoon and afternoon of yesterday yielded ·20 in.; the thunderstorm from 6.45 to 7.30 brought down ·99 in. (of which ·40 in. fell in ten minutes); between 9 and 11 p.m. ·50 in. fell, and a slight shower some time after midnight brought the total for the day up to 1·71 in.

“The capricious local distribution of such heavy rains makes it desirable that their occurrence in such a densely-peopled area as London should be closely studied, and at present this is impossible owing to the large tracts of town which are unprovided with a rain gauge.

HUGH ROBERT MILL.”

*62, Camden Square, N.W., 26th July, 1904.*

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### THE RAINFALL OF JULY 25th.

WE have received a large amount of correspondence on this subject, and could easily have filled this issue of the Magazine with letters from most parts of the country. The thunderstorm was a typical one—just the sort of storm that one expects to encounter towards the end of July; but it was in no way exceptionally severe. It is interesting to notice that while no case of rainfall exceeding 2·62 in. was reported, there are several instances of it being the heaviest fall experienced by observers. We quote a few of the more striking letters and refer to the Remarks on pp. 138–139 for others.

The following are the amounts for July 25th observed in London, the first name in each case is that of the Metropolitan Borough in which the station is situated :—

|                   |                                  |         |
|-------------------|----------------------------------|---------|
| FULHAM .....      | Edith Road, West Kensington..... | ·80 in. |
| BATTERSEA .....   | Battersea Park.....              | ·78 „   |
| WOOLWICH .....    | Court Road, Eltham .....         | 1·40 „  |
| LAMBETH.....      | Denmark Hill .....               | ·92 „   |
| HAMPSTEAD.....    | Burrard Road, West Hampstead...  | 2·24 „  |
| ST. PANCRAS ..... | Camden Square .....              | 1·71 „  |
| POPLAR.....       | Old Ford .....                   | 1·13 „  |

It will interest you to know that the rainfall here from 1 p.m. on 25th to 10 a.m. on 26th was 2·45 in.; ·22 in. fell afterwards before the rain ceased. This is by far the heaviest rainfall I have ever recorded. Of the 2·45 in., ·53 in. fell in less than an hour during a thunderstorm.

HERTFORD.

*Ragley Hall, Alcester, 27th July, 1904.*

On the 25th of July we had 2·35 in. of rain in a thunderstorm, the largest amount I have registered since beginning in 1895. Unluckily I was on my holiday, and, as often happens, missed the opportunity of detailed observation of an extreme fall.

R. P. DANSEY.

*Church Stretton, 2nd August, 1904.*

It may, perhaps, interest you to know that the rainfall here on the 25th inst. was 2·13 in.; of this, 1·05 in. fell between 1 p.m. and 7 p.m. and the remainder during the night.

H. TRETHERY.

*Hatton Vicarage, Warwick, 27th July, 1904.*

I registered 1·70 in. rain at 9 a.m. to-day. It all fell after 9 p.m. yesterday.

E. T. DOWSON.

*Geldeston, Beccles, July 26th, 1904.*

Heavy distant thunder and lightning to the E., N. and S. of us last evening from 6.15 to 9.30. The storm did not come over the village. Rain began to fall at 6.10; by 7 o'clock '07 in. had fallen, by 9 o'clock '42 in., and at 6.10 this morning 1·45 in. was registered for the 12 hours.

WILLIAM HALL.

*Swerford, Oxford, 26th July, 1904.*

The heavy rain measured on the morning of the 26th began at 4 p.m. of the 25th and was over before 8 a.m. of 26th, so fell in 16 hours. About an hour after commencement a sharp thunderstorm began, and lasted an hour or two in the closest proximity to this place; the interval between flash and clap being repeatedly almost nil. The total amount of rain was 1·41 in.

Heavy rain fell all around, but I think the amount here was in excess of most parts near.

E. HILL.

*The Rectory, Cockfield, Bury St. Edmunds.*

### EXTREMES OF TEMPERATURE IN JULY.

THE following newspaper extract and letter present a contrast in temperature, rarely if ever recorded before in the British Isles:—

“A JULY FROST IN SUTHERLANDSHIRE. — A correspondent, writing from Thurso, on Tuesday, July 19th, says:—This morning the north coast of Sutherland was visited by the severest frost experienced for a great number of years. In many cases the potato crop is done. Along the Strathnaver settlement the frost was most severe. The potato crop there was cut down on the 28th June, and was only beginning to recover. This second attack, which is fully more severe than that of the 28th June, means complete ruin to the

potato crop there this season. The loss will be a severe one to the settlers."—*Scotsman*.

THE maximum shade temperature recorded here yesterday (Sunday, July 17th) was 91° F., as registered by a thermometer certified at Kew Observatory, and placed in a Stevenson-pattern screen. The day was exceptionally clear, with an almost entire absence of wind until after sunset, when a brisk N.E. breeze sprang up.

This is the highest temperature recorded here since July, 1900, when we had several days over 90°. The previous highest this year was 85½° on Saturday, July 9th; and the absolute maximum reached since observations were started by me here in 1896, was 93° in June, 1897.

HAROLD E. FRIER.

*Risegate, Hadley Road, New Barnet, July 18th, 1904.*

The range of temperature between the Barnet maximum and the Strathnaver minimum must have exceeded sixty Fahrenheit degrees by a considerable amount, and although the two stations are separated by seven degrees of latitude, summer frosts are very rare phenomena indeed in the north of Scotland near sea-level.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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### BALL LIGHTNING.

I HAVE been reading with much interest the correspondence respecting Ball Lightning in the *Meteorological Magazine*, and the note to the letter by Mr. D. W. Horner, induces me to write to you. As a child of about 12, I was in a house which was struck by lightning, and still distinctly remember seeing what appeared like a great ball of fire poised above my bird cages for a few seconds; my belief is that it was, as you say, the "subjective impression of some luminous phenomenon."

On that occasion the electricity behaved with its usual eccentricity, deserting the pipe down which it was travelling to make the circuit of a small box-room, where it twisted a wire bonnet into a strange shape, and riddled a cotton dress with small holes such as might be made with the glowing end of a match; it then returned to the pipe and travelled safely to the ground. I have always been puzzled to think why the large bird cages were spared and the small wire bonnet frame destroyed, neither being in the direct line of communication.

GERTRUDE ELLIOT.

*Ardington House, Wantage, Berks, July 19th, 1904.*

## A WHIRLWIND.

IN the *Daily Mail* of June 29th, appeared accounts of two Whirlwinds, one at Willesden Green, the other near Bristol, occurring on June 28th. I was not myself at home on that day, but from three eye-witnesses, one of whom was the very best person in the parish to give a report of such a thing, I learn that on that same day, at about 3.30 p.m., a whirlwind crossed the paddock in front of my Rectory, belonging to me, and whisked up a lot of hay just ready for carrying, took it up to a great height (200 ft. I should infer), and then let it fall in the Churchyard and on the tower top, 72 ft. from ground, and on Cadbury House roof beyond the Church. From the quantity which I myself saw afterwards on the tower top, and on the tower staircase, and spread about the Churchyard, which it had littered badly, I should judge that there must have been a large quantity carried up by the wind—perhaps a ton. The course of the whirlwind was roughly from N.W. to S.E.

H. A. BOYS.

*North Cadbury Rectory, Somerset, July 26th, 1904.*

## AN OLD SEVERE WINTER.

Is this cutting from the *Dorset County Chronicle*, of 25th Jan., 1838, of any interest to you?

JAMES CROSS.

*Bailie House, Wimborne.*

“POOLE, 24th Jan., 1838.—The weather we experienced for the fortnight ending on Saturday last was intensely cold. With many fluctuations, but generally increasing in intensity, the cold on Friday night was so excessive as hardly to have been paralleled in the recorded meteorology of the town. On Friday evening it was observed that large crystals of ice were spreading over the waters of the harbour, and on Saturday morning the whole of that vast body of tidal water comprised in the harbour was covered with a sheet of ice, varying from one to three inches in thickness. The freezing of this estuary of the sea, subject as it is to the motion of the tide, &c., has not before occurred for the last forty-nine years. Fortunately, a thaw commenced on the afternoon of Saturday, or a total interruption must have taken place in the navigation of the harbour. During the prevalence of the severe weather, immense numbers of wild fowl frequented the shores and neighbourhood of the harbour, and were shot in unprecedented quantities.

“CHRISTCHURCH.—Such was the intensity of the frost last week, that the Christchurch Serpentine, alias the Stour, bordering on this town, was so completely frozen as safely to admit a very large concourse of persons of the town and neighbourhood to assemble on the ice on Friday last. Beauty and fashion promenaded on one part of the river; whilst a party was playing a most animated game of cricket on a distant part.”

## THE SEVEN MONTHS' RAINFALL OF 1904.

*Aggregate Rainfall for January—July, 1904.*

| Stations.             | Total Rain. | Per cent. of Aver. | Stations.         | Total Rain. | Per cent. of Aver. | Stations.         | Total Rain. | Per cent. of Aver. |
|-----------------------|-------------|--------------------|-------------------|-------------|--------------------|-------------------|-------------|--------------------|
|                       | in.         |                    |                   | in.         |                    |                   | in.         |                    |
| London .....          | 12·85       | 108                | Arnccliffe .....  | 34·26       | 108                | Braemar .....     | 14·58       | 85                 |
| Tenterden .....       | 15·18       | 110                | Hull .....        | 12·83       | 101                | Aberdeen .....    | 16·25       | 102                |
| Hartley Wintney ..... | 15·07       | 116                | Newcastle.....    | 13·77       | 104                | Cawdor .....      | 11·65       | 74                 |
| Hitchin .....         | 13·41       | 111                | Seathwaite ...    | 73·52       | 110                | Glencarron .....  | 45·44       | 96                 |
| Winslow .....         | 13·93       | 113                | Cardiff .....     | 26·20       | 137                | Dunrobin .....    | 15·66       | 98                 |
| Westley .....         | 12·41       | 94                 | Haverfordwest     | 24·03       | 114                | Killarney ...     | 31·48       | 113                |
| Brundall.....         | 11·80       | 91                 | Gogerddan ...     | 22·83       | 106                | Waterford ...     | 24·89       | 123                |
| Alderbury .....       | 17·46       | 125                | Llandudno ...     | 15·43       | 106                | Broadford... ..   | 22·51       | 130                |
| Ashburton .....       | 33·90       | 137                | Dumfries .....    | 23·44       | 105                | Carlow .....      | 19·33       | 110                |
| Polapit Tamar ...     | 27·92       | 155                | Lilliesleaf ..... | 18·94       | 121                | Dublin .....      | 13·92       | 97                 |
| Stroud .....          | 17·47       | 123                | Colmonell.....    | 21·31       | 97                 | Mullingar .....   | 21·32       | 111                |
| Woolstaston .....     | 16·92       | 114                | Glasgow .....     | 20·80       | 113                | Ballinasloe ..... | 22·39       | 118                |
| Boston .....          | 12·01       | 113                | Inveraray .....   | 37·96       | 104                | Clifden .....     | 49·89       | 122                |
| Hesley Hall .....     | 12·99       | 121                | Islay .....       | 26·64       | 119                | Crossmolina ...   | 35·58       | 135                |
| Derby.....            | 12·38       | 101                | Mull .....        | 33·27       | 118                | Seaforde .....    | 19·86       | 104                |
| Bolton .....          | 18·46       | 81                 | Loch Leven ...    | 19·03       | 103                | Londonderry..     | 21·14       | 101                |
| Wetherby .....        | 16·51       | 132                | Dundee .....      | 13·70       | 97                 | Omagh .....       | 24·75       | 123                |

The aggregate rainfall of the seven months is below the average of the ten years 1890-99 in the east and north-west of England, in the north and south-west of Scotland, and in the neighbourhood of Dublin. It considerably exceeds the average only in the south-west of England; and, bearing in mind the fact that the ten years yielding this average were dry years, it cannot be wrong to say that so far the British Isles have not had more than the average amount of rainfall during the year 1904.

The fineness of the summer months has been a pleasant contrast to the state of matters last year, and complaints, where complaints are heard, deal with droughts rather than floods. Taken as a whole, the rainfall of the British Isles for the first seven months of 1903 showed an excess of 37 per cent., and in 1904 of 9 per cent. above the ten years' average; or an excess of over 25 per cent. of the true average in 1903, and nothing in 1904.

Still, while the greater part of the country has been very much drier this year than last, several stations in the south-west of England and in Ireland have had more rain. The relatively driest part of the country has been the north-east of Scotland; the relatively wettest the peninsula of Devon and Cornwall.

RAINFALL AND TEMPERATURE, JULY, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.      |                                   |                          |       |      | Days on which<br>0.1 or more fell. | TEMPERATURE. |      |        |       | No. of<br>Nights<br>below<br>32°. |     |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------|--------------------------|-------|------|------------------------------------|--------------|------|--------|-------|-----------------------------------|-----|
|        |                                                                                                                                      | Total<br>Fall. | Diff. from<br>average,<br>1890-9. | Greatest in<br>24 hours. |       | Max. |                                    | Min.         |      | Shade  | Grass |                                   |     |
|        |                                                                                                                                      |                |                                   | Depth                    | Date. | Deg. |                                    | Date.        | Deg. |        |       | Date.                             |     |
| I.     | London (Camden Square) ...                                                                                                           | 2.41           | + .16                             | 1.71                     | 25    | 10   | 88.9                               | 17           | 49.7 | 4      | 0     | 0                                 | 0   |
| II.    | Tenterden.....                                                                                                                       | 2.16           | — .44                             | .69                      | 30    | 8    | 86.0                               | 17           | 50.0 | 2      | 0     | 0                                 | 0   |
|        | Hartley Wintney .....                                                                                                                | 2.06           | — .30                             | .47                      | 2     | 9    | 86.0                               | 17           | 48.0 | 1, 21  | 0     | 0                                 | 0   |
| III.   | Hitchin ..                                                                                                                           | 3.78           | + 1.37                            | 2.62                     | 25    | 11   | 84.0                               | 15           | 48.0 | 18     | 0     | 0                                 | 0   |
|        | Winslow (Addington) .....                                                                                                            | 2.74           | + .27                             | 1.47                     | 25    | 12   | 84.0                               | 10, 17       | 48.0 | 4, 8   | 0     | 0                                 | 0   |
| IV.    | Bury St. Edmunds (Westley) ..                                                                                                        | 2.51           | — .40                             | .59                      | 27    | 10   | 86.0                               | 17           | 47.0 | 19     | 0     | 0                                 | 0   |
|        | Brundall .....                                                                                                                       | 1.85           | — 1.02                            | .60                      | 25    | 9    | 86.8                               | 15           | 46.2 | 4      | 0     | 0                                 | 0   |
| V.     | Alderbury .....                                                                                                                      | 2.27           | — .05                             | .60                      | 25    | 11   | 82.0                               | 10           | 46.0 | 1      | 0     | 0                                 | 0   |
|        | Winterborne Steepleton .....                                                                                                         | 3.87           | ...                               | 1.12                     | 29    | 13   | 80.8                               | 17           | 45.8 | 9      | 0     | 0                                 | 0   |
|        | Torquay (Cary Green) .....                                                                                                           | 4.62           | ...                               | .85                      | 26    | 16   | 77.9                               | 17           | 50.1 | 4      | 0     | 0                                 | 0   |
|        | Polapit Tamar [Launceston] ..                                                                                                        | 5.73           | + 2.71                            | 1.50                     | 26    | 23   | 82.6                               | 10           | 36.9 | 8      | 0     | 0                                 | 0   |
|        | Bath .....                                                                                                                           | 2.45           | ...                               | .72                      | 25    | 12   | 83.5                               | 10           | 48.2 | 8      | 0     | 0                                 | 0   |
| VI.    | Stroud (Upfield).....                                                                                                                | 3.46           | + .85                             | .89                      | 26    | 12   | 83.0                               | 10           | 48.0 | 28     | 0     | 0                                 | 0   |
|        | Church Stretton (Wooltaston) ..                                                                                                      | 3.06           | + .73                             | 2.48                     | 25    | 14   | 76.0                               | 11, 19       | 61.0 | 2      | 0     | 0                                 | 0   |
|        | Bromsgrove (Stoke Reformatory) ..                                                                                                    | 2.49           | + .70                             | 1.65                     | 25    | 10   | 81.0                               | 9            | 41.0 | 1      | 0     | 0                                 | 0   |
| VII.   | Boston .....                                                                                                                         | 3.05           | + .93                             | 1.00                     | 24    | 10   | 87.0                               | 9            | 45.0 | 2      | 0     | 0                                 | 0   |
|        | Bawtry (Hesley Hall) .....                                                                                                           | 3.60           | + 1.63                            | 1.02                     | 24    | 10   | 82.0                               | 11           | 40.0 | 8, 19  | 0     | 0                                 | 0   |
|        | Derby (Midland Railway).....                                                                                                         | 1.95           | — .36                             | .91                      | 25    | 11   | 88.0                               | 10           | 47.0 | 1, 7   | 0     | 0                                 | 0   |
| VIII.  | Bolton (The Park) .....                                                                                                              | 1.71           | — 2.39                            | .40                      | 4     | 16   | 78.4                               | 11           | 44.4 | 8      | 0     | 0                                 | 0   |
| IX.    | Wetherby (Ribston Hall) .....                                                                                                        | 2.08           | — .21                             | .70                      | 24    | 12   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
|        | Arncliffe Vicarage .....                                                                                                             | 2.40           | — 2.63                            | .93                      | 23    | 15   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
|        | Hull (Pearson Park) .....                                                                                                            | 3.35           | + 1.03                            | 1.50                     | 24    | 12   | 82.0                               | 15           | 44.0 | 19     | 0     | 0                                 | 0   |
| X.     | Newcastle (Town Moor) .....                                                                                                          | 1.49           | — 1.20                            | .32                      | 25    | 14   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
|        | Borrowdale (Seathwaite) .....                                                                                                        | 8.51           | — .90                             | 3.00                     | 16    | 16   | 82.3                               | 11           | 46.5 | 18     | 0     | 0                                 | 0   |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 5.12           | + 1.88                            | 1.80                     | 25    | 20   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
|        | Haverfordwest (High St.).....                                                                                                        | 1.95           | — 1.39                            | .32                      | 30    | 19   | 83.6                               | 10           | 40.2 | 8      | 0     | 0                                 | 0   |
|        | Aberystwith (Gogerddan).....                                                                                                         | 2.61           | — 1.01                            | .83                      | 25    | 13   | 93.0                               | 10, 11       | 35.0 | 29     | 0     | 0                                 | 0   |
|        | Llandudno .....                                                                                                                      | 2.37           | — .21                             | .66                      | 24    | 20   | 80.2                               | 11           | 49.8 | 8      | 0     | 0                                 | 0   |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 3.83           | + .49                             | 1.78                     | 15    | 12   | 83.0                               | 11           | 43.0 | 7      | 0     | 0                                 | 0   |
| XIII.  | Edinburgh (Royal Observy.) ..                                                                                                        | 1.19           | ...                               | .40                      | 15    | 13   | 70.4                               | 29           | 46.8 | 4      | 0     | 0                                 | 0   |
| XIV.   | Colmonell.....                                                                                                                       | 3.20           | — .00                             | .70                      | 14    | 13   | 82.0                               | 11           | 41.0 | 17     | 0     | 0                                 | 0   |
| XV.    | Tighnabruaich .....                                                                                                                  | 4.08           | ...                               | .79                      | 14    | 18   | 70.0                               | 11           | 40.0 | 16     | 0     | 0                                 | 0   |
|        | Mull (Quinish).....                                                                                                                  | 2.87           | — 1.24                            | .83                      | 14    | 19   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 2.02           | — 1.05                            | .90                      | 16    | 11   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
|        | Dundee (Eastern Necropolis) ..                                                                                                       | 1.15           | — 1.21                            | .30                      | 3, 15 | 11   | 75.8                               | 13           | 44.0 | 4      | 0     | 0                                 | 0   |
| XVII.  | Braemar .....                                                                                                                        | 1.73           | — 1.04                            | .37                      | 22    | 12   | 74.8                               | 10           | 38.2 | 18     | 0     | 0                                 | 2   |
|        | Aberdeen (Cranford) .....                                                                                                            | 1.32           | — 1.31                            | .60                      | 2     | 10   | 71.0                               | 8, 30        | 43.0 | 2      | 0     | 0                                 | 0   |
|        | Cawdor (Budgate) .....                                                                                                               | .63            | — 2.79                            | .27                      | 20    | 9    | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
| XVIII. | Glencarron Lodge .....                                                                                                               | 2.38           | — 4.52                            | .61                      | 6     | 19   | 78.9                               | 12           | 34.0 | 31     | 0     | 0                                 | 0   |
|        | Bendamph.....                                                                                                                        | 3.16           | — 2.33                            | .63                      | 6     | 17   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
| XIX.   | Dunrobin Castle .....                                                                                                                | 1.14           | — 1.56                            | .41                      | 3     | 9    | 72.0                               | 30           | 44.0 | 19     | 0     | 0                                 | 0   |
|        | Castletown .....                                                                                                                     | 1.04           | ...                               | .26                      | 2     | 14   | 76.0                               | 31           | 40.0 | 19, 20 | 0     | 0                                 | 0   |
| XX.    | Killarney .....                                                                                                                      | 5.10           | + .68                             | .84                      | 15    | 23   | 82.5                               | 11           | 40.5 | 7      | 0     | 0                                 | 0   |
|        | Waterford (Brook Lodge).....                                                                                                         | 3.83           | + .45                             | .72                      | 14    | 18   | 77.0                               | 11           | 42.0 | 7      | 0     | 0                                 | 0   |
|        | Broadford (Hurdlestown) .....                                                                                                        | 4.11           | + 1.13                            | .56                      | 19    | 23   | 77.0                               | 11           | 42.0 | 6, 7   | 0     | 0                                 | 0   |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 3.34           | + .39                             | .95                      | 15    | 17   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
|        | Dublin (Fitz William Square) ..                                                                                                      | 1.09           | — 1.49                            | .32                      | 15    | 15   | 74.7                               | 30           | 48.0 | 7      | 0     | 0                                 | 0   |
| XXII.  | Ballinasloe .....                                                                                                                    | 3.78           | + .51                             | .70                      | 26    | 20   | 80.0                               | 11           | 44.0 | 7, 16  | 0     | 0                                 | 0   |
|        | Clifden (Kylemore House).....                                                                                                        | 8.85           | + 2.26                            | 1.70                     | 25    | 19   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
| XXIII. | Seaforde .....                                                                                                                       | 2.31           | — .88                             | .34                      | 4, 28 | 17   | 76.0                               | 9, 10        | 47.0 | 15     | 0     | 0                                 | 0   |
|        | Londonderry (Creggan Res.) ..                                                                                                        | 4.05           | + .35                             | .52                      | 19    | 21   | ...                                | ...          | ...  | ...    | ...   | ...                               | ... |
|        | Omagh (Edenfel).....                                                                                                                 | 4.41           | + .86                             | .72                      | 19    | 22   | 80.0                               | 11           | 45.0 | 15     | 0     | 0                                 | 0   |

+ Shows that the fall was above the average; — that it was below it.

## SUPPLEMENTARY RAINFALL, JULY, 1904.

| Div.  | STATION.                             | Rain.<br>inches | Div.   | STATION.                           | Rain.<br>inches |
|-------|--------------------------------------|-----------------|--------|------------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....          | 1·40            | XI.    | New Radnor, Ednol .....            | 2·75            |
| „     | Sheppey, Leysdown .....              | 1·15            | „      | Rhayader, Nantgwilt .....          | ...             |
| „     | Hailsham .....                       | 1·26            | „      | Lake Vyrnwy .....                  | 2·76            |
| „     | Crowborough .....                    | 1·09            | „      | Ruthin, Plas Drâw .....            | 1·65            |
| „     | Ryde, Beldornie Tower .....          | 1·00            | „      | Criccieth, Talarvor .....          | 2·30            |
| „     | Emsworth, Redlands .....             | 2·12            | „      | Anglesey, Lligwy .....             | 1·86            |
| „     | Alton, Ashdell .....                 | 1·26            | „      | Douglas, Woodville .....           | 2·31            |
| „     | Newbury, Welford Park .....          | 2·38            | XII.   | Stoneykirk, Ardwell House .....    | 4·08            |
| III.  | Harrow Weald .....                   | 2·95            | „      | Dalry, Old Garroch .....           | 3·35            |
| „     | Oxford, Magdalen College .....       | 3·05            | „      | Langholm, Drove Road .....         | 5·34            |
| „     | Banbury, Bloxham .....               | 3·10            | „      | Moniaive, Maxwellton House .....   | 3·77            |
| „     | Pitsford, Sedgebrook .....           | 2·61            | „      | Lilliesleaf, Riddell .....         | 2·65            |
| „     | Huntingdon, Brampton .....           | 1·53            | XIII.  | N. Esk Reservoir [Penicuick] ..... | 2·80            |
| „     | Wisbech, Bank House .....            | 1·84            | XIV.   | Maybole, Knockdon Farm .....       | 1·77            |
| IV.   | Southend .....                       | 2·74            | „      | Glasgow, Queen's Park .....        | 3·81            |
| „     | Colchester, Lexden .....             | 3·07            | XV.    | Inveraray, Newtown .....           | 4·11            |
| „     | Saffron Waldon, Newport .....        | 2·21            | „      | Ballachulish, Ardsheal .....       | 5·31            |
| „     | Rendlesham Hall .....                | 1·83            | „      | Campbeltown, Redknowe .....        | 3·09            |
| „     | Swaffham .....                       | 2·91            | „      | Islay, Eallabus .....              | 3·77            |
| „     | Blakeney .....                       | 3·37            | XVI.   | Dollar .....                       | 2·36            |
| V.    | Bishop's Cannings .....              | 3·18            | „      | Balquhider, Stronvar .....         | 4·71            |
| „     | Ashburton, Druid House .....         | 5·04            | „      | Coupar Angus Station .....         | 2·28            |
| „     | Okehampton, Oaklands .....           | 3·88            | „      | Blair Atholl .....                 | 1·77            |
| „     | Hartland Abbey .....                 | 4·10            | „      | Montrose, Sunnyside .....          | 1·09            |
| „     | Lynmouth, Rock House .....           | 3·27            | XVII.  | Alford, Lynturk Manse .....        | 1·61            |
| „     | Probus, Lamellyn .....               | 5·25            | „      | Keith, H.R.S. .....                | ·86             |
| „     | Wellington, The Avenue .....         | 3·14            | XVIII. | Fearn, Lower Pitkerrie .....       | 3·03            |
| „     | North Cadbury Rectory .....          | 3·80            | „      | S. Uist, Askernish .....           | 2·29            |
| VI.   | Clifton, Pembroke Road .....         | 4·40            | „      | Invergarry .....                   | 2·18            |
| „     | Moreton-in-Marsh, Longboro' .....    | 3·09            | „      | Aviemore, Alvie Manse .....        | 1·04            |
| „     | Ross, The Graig .....                | 1·90            | „      | Loch Ness, Drumnadrochit .....     | ·87             |
| „     | Shifnal, Hatton Grange .....         | 1·72            | XIX.   | Invershin .....                    | ·75             |
| „     | Wem Rectory .....                    | 2·48            | „      | Altnaharra .....                   | 1·47            |
| „     | Cheadle, The Heath House .....       | 2·31            | „      | Bettyhill .....                    | 1·28            |
| „     | Coventry, Kingswood .....            | 2·32            | „      | Watten, H.R.S. .....               | 1·53            |
| VII.  | Market Overton .....                 | 3·57            | XX.    | Cork, Wellesley Terrace .....      | 3·56            |
| „     | Market Rasen .....                   | 3·37            | „      | Darrynane Abbey .....              | 5·27            |
| „     | Worksop, Hodsock Priory .....        | 2·23            | „      | Glenam [Clonmel] .....             | 4·37            |
| VIII. | Neston, Hinderton .....              | 1·74            | „      | Ballingarry, Hazelfort .....       | 3·37            |
| „     | Southport, Hesketh Park .....        | 1·02            | „      | Miltown Malbay .....               | 6·68            |
| „     | Chatburn, Middlewood .....           | 1·81            | XXI.   | Gorey, Courtown House .....        | 2·56            |
| „     | Duddon Valley, Seathwaite Vic. ..... | 5·74            | „      | Moynalty, Westland .....           | 3·54            |
| IX.   | Langsett Moor, Up. Midhope .....     | 1·81            | „      | Athlone, Twyford .....             | 3·88            |
| „     | Baldersby .....                      | 1·67            | „      | Mullingar, Belvedere .....         | 3·21            |
| „     | Scalby, Silverdale .....             | 1·66            | XXII.  | Woodlawn .....                     | 3·47            |
| „     | Ingleby Greenhow .....               | 2·61            | „      | Westport, Murrisk Abbey .....      | 6·07            |
| „     | Middleton, Mickleton .....           | 2·29            | „      | Crossmolina, Enniscoe .....        | 5·60            |
| X.    | Beltingham .....                     | 1·54            | „      | Collooney, Markree Obsy .....      | 4·53            |
| „     | Bamburgh .....                       | 1·15            | XXIII. | Enniskillen, Portora .....         | 4·27            |
| „     | Keswick, The Bank .....              | 3·28            | „      | Warrenpoint .....                  | 3·43            |
| „     | Melmerby Rectory .....               | 2·32            | „      | Banbridge, Milltown .....          | 2·96            |
| XI.   | Llanfrechfa Grange .....             | 4·85            | „      | Belfast, Springfield .....         | 3·75            |
| „     | Treherbert, Tyn-y-waun .....         | 5·67            | „      | Bushmills, Dundarave .....         | 2·61            |
| „     | Llandoverly, Tonn .....              | 3·27            | „      | Stewartstown .....                 | 4·35            |
| „     | Castle Malgwyn .....                 | 1·95            | „      | Killybegs .....                    | 3·99            |
| „     | Llandefaelog-fach .....              | ...             | „      | Horn Head .....                    | 3·19            |

## METEOROLOGICAL NOTES ON JULY, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm. R for Rain; H for Hail; S for Snow.

## ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A fine, warm and sunny month, which would have been very deficient in R but for a fall of 1.71 in. on the evening of 25th, in the course of which during a severe TS .61 in. of R fell in 20 minutes. The duration of sunshine 234.8 hours\* and of R 20.8 hours. Mean temp. 66°·5 or 3°·2 above the average. Max. above 80° on 11 days.

TENTERDEN.—A glorious summer month. Duration of sunshine 293 hours 25 mins.† Temp. 75° or more on 17 days and on four over 80°. Several TSS, especially in the last week.

CROWBOROUGH.—Fine, dry and warm, with deficient R. TSS on 3rd, 12th and 30th. Mean temp. 62°·9.

HARTLEY WINTNEY.—A "mensis mirabilis." The first three days were stormy, with R, followed by a spell of glorious summer weather till 25th; hot, dry and dusty. The closing days were showery, with absence of T, and beautiful nights. Ozone on 14 days with a mean of 2.1.

HITCHIN.—Since 1849 there had been only three hotter Julys. The fall of 2.62 in. on 25th was the heaviest in 24 hours since October, 1857.

ADDINGTON MANOR.—Little R until the end, but a heavy TS on 25th, when a large oak tree was struck by L.

PITSFORD.—A month of warmth and sunshine. R 1.00 in. below the average. Mean temp. 63°·8. T, L and heavy R on 25th.

COLCHESTER.—Very dry till 25th, accentuated by E. wind and great heat. Crops and all vegetation except large trees suffered much. On 25th there was a violent TS passing directly over this garden. From 5.55 to 6.6 $\frac{3}{4}$  p.m. .37 in. of R fell; from 6.6 $\frac{3}{4}$  to 6.13, .57 in., and from 6.13 to 6.20, .38 in., making 1.32 in. in 25 minutes.

BURY ST. EDMUNDS.—Very hot and dry till 25th, after which 2.10 in. of R fell.

BRUNDALL.—Very hot, with mean temp. 3°·0 above the average. Severe storms of T and R during the last few days.

WINTERBOURNE STEEPLTON.—Temp. above the average, especially during the second fortnight. The R nearly all fell in the last week. T and L on 12th and 19th.

TORQUAY.—R 2.22 in. above the average, 4.18 in. falling from 22nd to 29th. Duration of sunshine 240.8 hours\* or 5.2 hours above the average. Mean temp. 62°·8 or 1°·1 above the average. Mean amount of ozone 3.8.

NORTH CADBURY.—The first five days were cloudy, showery and cool, after which it was hot, dry and bright till 24th, then tremendous rains, excessive humidity and gloom turned a hitherto dry month into the wettest July in 8 years, and wetter than any month in 1903, except October.

CLIFTON.—Fine and hot with little exception till 22nd, when the weather broke up. TSS on 19th and 25th and torrential rains on 25th (1.22 in.) and 26th (1.18 in.), followed by daily R till the end, 3.32 in. falling in the last week.

ROSS.—The dry weather which had persisted from June 1st continued till July 21st, with the exception of a slight T shower on 19th. The Wye was unusually low and within an inch of record minimum height. From 22nd to 29th frequent refreshing showers occurred. The great heat from 6th to 25th enabled the later grass crops to be well secured and rapidly ripened grain crops.

WOOLSTASTON.—There was a very heavy TS on 25th lasting from 2.45 to 3.45 p.m., the R in the hour being 1.26 in. A tall Wellingtonia only 15 yards from the rectory was struck by L.

BOLTON.—The weather was highly favourable to agriculture. The duration

of sunshine was 151 hours 55 minutes,\* or 1 hour above the average. The mean temp.,  $60^{\circ}\cdot9$ , was  $0^{\circ}\cdot6$  above the average, and the R was sufficient for steady growth owing to moisture in the soil. The hay crop was secured in excellent condition. T and L on 2nd and 12th; T on 23rd and 31st, and L on 24th.

**SOUTHPORT.**—Warm and very dry with large mean daily range of temp. and low humidity. Mean temp.  $2^{\circ}\cdot1$  above the average. R  $2\cdot13$  in. below the average of 32 years. Underground water low.

**HULL.**—Exceptionally warm throughout, with hot, dry periods, succeeded by copious rain, followed again by fine weather. T on 2nd and 23rd, and T and L on 25th and 30th.

**LLANDOVERY.**—Changeable, but fine on the whole. Several TSS occurred, and there was a very brilliant display of L on the night of 19th. Range of temp. on 7th  $40^{\circ}$  and on 8th  $41^{\circ}$ .

**HAVERFORDWEST.**—The finest and warmest July since 1900. Temp. reached  $70^{\circ}$  or more on 11 days. Distant TS on 12th. Duration of sunshine  $226\cdot7$  hours.\*

**DOUGLAS.**—On the whole a pleasant month. The first days were cold and unsummerlike, but the weather improved thereafter, although only 25 hours sunshine were recorded in the last week. A remarkably severe gale lasted some 50 hours, including 14th and 15th. TSS on 12th and 25th.

#### SCOTLAND.

**CARGEN [DUMFRIES].**—Grand hay weather, and corn and green crop prospects exceptionally good. More than half the R fell between midnight and 10 p.m. on 15th.

**LILLIESLEAF.**—R  $\cdot35$  in. below the average. Heavy R on four days, but no T. Remarkably heavy growth of vegetation. Little sunshine.

**MULL, QUINISH.** Fine and warm. R always sufficient and never excessive.

**COUPAR ANGUS.**—Bright sunshine and blue sky were deficient, and a struggling sun through a hazy atmosphere predominated, with a small daily range of temp.

**DRUMNADROCHIT.**—The R was less than half the previous lowest in 18 years, and  $2\cdot12$  in. below the average of that period. Vegetation suffered much from drought, and in some cases cattle had to be turned into cornfields for want of grass.

**BETTYHILL.**—With the exception of a little in the early part, there was scarcely any R, and crops and pasture were failing.

**WATTEN.**—Cloudy, fine and very dry, though with few sunny days.

**CASTLETOWN.**—The first part was warm and showery with westerly winds, and the latter warm and very dry, with light variable winds and cloudy and overcast skies.

#### IRELAND.

**DARRYNANE ABBEY.**—Wet, with some fine and hot intervals. R 34 per cent. above the average.

**MILTOWN MALBAY.**—Sultry and wet, with much T during the last fortnight. The heaviest R but one for 32 years. On the night of 25th  $2\cdot85$  in. fell in 8 hours. Potato blight everywhere.

**DUBLIN.**—Warm and generally fine. The R was small but fell on 15 days, although more than half fell on 15th and 25th. TS on 19th.

**MARKREE OBSERVATORY.**—The first part was fine and dry, but from 19th heavy showers fell, and there were frequent TSS.

**OMAGH.**—Although the R was above the average, it fell so largely at night that, accompanied as it was by higher temp., it seemed much drier than July, 1903, which had smaller R. Fruit, both large and small, was quite phenomenal, and ordinary crops promised equal abundance. Little T or L.

\* Campbell-Stokes.

† Jordan

Climatological Table for the British Empire, February, 1904

| STATIONS.<br><br><i>(Those in italics are South of the Equator.)</i> | Absolute. |       |          |       | Average. |       |            |           | Absolute.    |                | Total Rain. |       | Aver.  |
|----------------------------------------------------------------------|-----------|-------|----------|-------|----------|-------|------------|-----------|--------------|----------------|-------------|-------|--------|
|                                                                      | Maximum.  |       | Minimum. |       | Max.     | Min.  | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth.      | Days. | Cloud. |
|                                                                      | Temp.     | Date. | Temp.    | Date. |          |       |            |           |              |                |             |       |        |
| London, Camden Square                                                | 54·3      | 20    | 27·9     | 29    | 44·6     | 34·3  | 35·2       | 86        | 85·6         | 41·4           | 2·58        | 19    | 7·1    |
| Malta.....                                                           | 63·7      | 3     | 44·3     | 26    | 62·5     | 5·6   | 47·2       | 77        | 111·9        | 39·8           | ·89         | 6     | 3·7    |
| Lagos, W. Africa .....                                               | 91·0      | 7, 16 | 68·0     | 25    | 87·6     | 74·0  | 73·2       | 71        | 130·5        | 63·0           | 1·17        | 2     | 2·7    |
| <i>Cape Town</i> .....                                               | 96·8      | 3     | 54·4     | 7, 8  | 79·8     | 62·0  | 57·7       | 64        | ...          | ...            | ·09         | 2     | 3·2    |
| <i>Durban, Natal</i> .....                                           | 95·4      | 7     | 61·4     | 1     | 84·4     | 67·7  | ...        | ...       | 151·5        | ...            | 8·77        | 18    | 4·7    |
| <i>Mauritius</i> .....                                               | 89·9      | 22    | 70·4     | 3     | 85·7     | 73·2  | 71·3       | 78        | 152·8        | 66·0           | 4·92        | 22    | 7·5    |
| Calcutta.....                                                        | 90·4      | 28    | 47·0     | 2     | 82·9     | 59·1  | 56·8       | 62        | 145·8        | 40·4           | 2·58        | 2     | 0·9    |
| Bombay.....                                                          | 91·2      | 13    | 66·8     | 6     | 85·3     | 70·5  | 66·2       | 69        | 139·2        | 58·4           | ·00         | 0     | 1·7    |
| Madras .....                                                         | 87·0      | 29    | 61·2     | 1     | 84·4     | 66·7  | 66·6       | 76        | 138·7        | 56·4           | ·00         | 0     | 2·1    |
| Kodaikanal .....                                                     | 71·1      | 15    | 42·6     | 27    | 64·7     | 46·6  | 37·8       | 53        | 135·1        | 23·4           | ·15         | 3     | 3·0    |
| Colombo, Ceylon.....                                                 | 92·7      | 25    | 65·0     | 3, 4  | 87·9     | 70·9  | 69·3       | 76        | 152·7        | 59·2           | 2·05        | 4     | 3·2    |
| Hongkong.....                                                        | 73·5      | 21    | 52·5     | 9     | 68·1     | 58·5  | 52·7       | 69        | 127·6        | ...            | ·20         | 3     | 3·7    |
| <i>Melbourne</i> .....                                               | 96·7      | 18    | 49·0     | 29    | 73·7     | 56·8  | 54·4       | 73        | 152·2        | 41·8           | 6·24        | 10    | 6·3    |
| <i>Adelaide</i> .....                                                | 104·0     | 17    | 52·0     | 28    | 81·4     | 61·5  | 51·3       | 51        | 153·6        | 47·2           | ·27         | 6     | 4·9    |
| <i>Coolgardie</i> .....                                              | 107·5     | 3     | 48·2     | 25    | 88·6     | 60·1  | 48·5       | 40        | 180·5        | 44·0           | ·00         | 0     | 1·4    |
| <i>Sydney</i> .....                                                  | 84·2      | ...   | 52·5     | ...   | 76·1     | 63·3  | 59·2       | 69        | 126·9        | 43·1           | 3·95        | 15    | 5·6    |
| <i>Wellington</i> .....                                              | 80·4      | 10    | 47·3     | 20    | 70·9     | 55·6  | 51·9       | 67        | 132·0        | 42·0           | 2·26        | 7     | 5·9    |
| <i>Auckland</i> .....                                                | 79·5      | 18    | 53·0     | 20    | 72·6     | 59·7  | 57·2       | 74        | 147·0        | 48·0           | 3·71        | 9     | 4·5    |
| Jamaica, Negril Point..                                              | 88·5      | 19    | 64·3     | 28    | 84·3     | 68·1  | 68·6       | 79        | ...          | ...            | 4·50        | 9     | ...    |
| Trinidad .....                                                       | 87·0      | sevl  | 61·0     | 24a   | 84·6     | 65·7  | 69·3       | 63        | 167·0        | 58·0           | 2·56        | 16    | ...    |
| Grenada.....                                                         | 84·8      | 26    | 68·4     | 22    | 80·9     | 71·1  | 68·6       | 75        | 150·4        | ...            | 3·33        | 19    | 2·9    |
| Toronto .....                                                        | 42·0      | 28    | -10·5    | 16    | 22·3     | 4·3   | 13·5       | 85        | 88·0         | -18·0          | 3·00        | 12    | 5·5    |
| Fredericton .....                                                    | 49·8      | 22    | 35·0     | 6     | 22·9     | -0·2  | 4·7        | 61        | ...          | ...            | 2·79        | 13    | 5·1    |
| Winnipeg .....                                                       | 36·0      | 27    | -35·8    | 9     | 3·2      | -18·9 | ...        | ...       | ...          | ...            | ·71         | 6     | 4·0    |
| Victoria, B.C. ....                                                  | 49·3      | 21    | 24·5     | 8     | 43·3     | 35·5  | ...        | ...       | ...          | ...            | 3·93        | 22    | 8·2    |
| Dawson .....                                                         | -3·0      | 1     | -48·0    | 4     | -17·8    | -31·7 | ...        | ...       | ...          | ...            | ·36         | 5     | 3·8    |

a and 25, 26.

MALTA.—Mean temp. of air 56°·6 or 2°·5 above, mean hourly velocity of wind 13·8 or 2·1 above, averages. Mean temp. of sea 59°·9.

Mauritius.—Mean temp. of air 0°·2, dew point 0°·4 above, and R 2·03 in. below, averages. Mean hourly velocity of wind 9·5 miles, or 1·5 mile below average.

KODAIKANAL.—Mean temp. of air 53°·9. Mean velocity of wind 329 miles per day. Bright sunshine 239·3 hours.

CEYLON, COLOMBO.—Mean temp. of air 79°·0 or 1°·3 below, dew point 1°·2 below, and R ·02 in. below, averages. Mean hourly velocity of wind 9 miles; prevailing direction N.

HONGKONG.—Mean temp. of air 62°·6. Bright sunshine 207·5 hours. Mean hourly velocity of wind 13·9 miles; mean direction E.

Adelaide.—Mean temp. of air 2°·6 below, and R ·35 in. below, normal.

Sydney.—Mean temp. of air 1°·3, humidity 3·5, and R ·93 in. below, averages.

Wellington.—Mean temp. 1°·9 above, and R ·38 in. above, averages; prevailing winds, N. and N.W.

TRINIDAD.—R ·91 in. above the 40 years' average.

# Symons's Meteorological Magazine.

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## METEOROLOGY AT THE BRITISH ASSOCIATION.

THE meeting of the British Association for the Advancement of Science, at Cambridge, in 1904, will rank amongst the very best of the long series since these gatherings began. The place lends itself remarkably to the occasion. The meeting-rooms were adequate, and in almost every case pleasantly as well as conveniently situated. The Colleges were thrown open with a dignified hospitality worthy of their splendid halls and gardens, while private hosts vied with them in the generous reception and entertainment of visitors. The weather was neither bad nor good, but of a fair average, permitting outdoor functions, but rarely permitting them to be altogether perfect.

The President of the Association is this year the most popular statesman in the country, and since the Association permits itself to stray beyond the votaries of science in its choice, it could not secure a better head than the present Prime Minister, for Mr. Arthur Balfour alone amongst parliamentary leaders is admired and esteemed for his great learning and attractive personal qualities no less warmly by his political opponents than by his supporters. He delivered an address on the philosophic aspects of some fundamental scientific facts, in a manner altogether agreeable.

A special International Committee on the relation between meteorological and cosmical phenomena, brought together several meteorologists from other countries. The sub-section of Section A devoted to Cosmical Physics, including astronomy and meteorology, was presided over by Sir John Eliot, F.R.S., part of whose address, admirably summarising his work of a lifetime as the head of the Indian Meteorological Service, we reprint in the present number. Numerous papers on meteorological subjects were read, and the more important of these will be reprinted in abstract in our pages, so that it is unnecessary to give a list of titles here.

The annual Meteorological Breakfast was held on Tuesday, 23rd August, at 9 a.m., when forty-three meteorologists and observers sat down. The names of those who took part are:—

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Ackroyd, W.<br/>Aitken, J., F.R.S.<br/>Amery, Fabian S.<br/>Angot, A., Central Meteorological<br/>Institute, Paris.<br/>Ashworth, Dr. J. R.<br/>Backlund, Dr. O., Pulkovo, Russia.<br/>Biggs, J. H. W.<br/>Bolton, John<br/>Boys, C. V., F.R.S.<br/>Chree, Dr. C., F.R.S.<br/>Cohen, R. Waley.<br/>Cotton, G., Lagos, West Africa.<br/>Creak, Capt. E. W., C.B., F.R.S.<br/>Crowley, F.<br/>Eliot, Sir John, K.C.I.E., F.R.S.<br/>Guillemard, Dr. F. H. H.<br/>Harmer, F. W.<br/>Hepworth, Capt. Campbell, C.B.<br/>Hettner, Prof. Dr. A., Heidelberg.<br/>Hopkinson, J.<br/>Knott, Dr. C. G.<br/>Lempfert, R. G. K.<br/>Lockyer, Sir Norman, K.C.B., F.R.S.</p> | <p>Lockyer, Dr. W. J. S.<br/>Matthews, D. J.<br/>Mill, Dr. H. R.<br/>Milne, Prof. J., F.R.S.<br/>Moncrieff, Col. Sir C. Scott, K.C.M.G.<br/>Parker, Rev. Dr. J. D.<br/>Plummer, W. E.<br/>Ricco, Prof. A., Cantania, Sicily.<br/>Rotch, A. Lawrence, Blue Hill<br/>Observatory, Massachusetts.<br/>Shaw, Dr. W. N., F.R.S.<br/>Smyth, J.<br/>Southall, H.<br/>Steen, Aksel S., Meteorological In-<br/>stitute, Christiania<br/>Symons, Dr. W. H.<br/>Tabor, H. S.<br/>Varley, W. M.<br/>Warner, A.<br/>Wilson, C. T. R., F.R.S.<br/>Wilson, W.<br/>Wind, Dr. C. H., Meteorological<br/>Institute, de Bilt, Holland.</p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

The key-note of this breakfast is its absolute informality. Sir John Eliot, as President of the Section dealing with Meteorology, expressed in a few words the welcome of the English-speaking meteorologists to their brethren from the continent. Dr. H. R. Mill made a few remarks on the origin and motive of the breakfast, pointing out that it was a spontaneous meeting of those interested in the same things and desirous of becoming acquainted with each other. No invitations were issued, but foreign guests were entertained by such of the British meteorologists as cared to share the trifling expense. An intimation was sent to all those likely to be interested whose names appeared in the first list of members, but as the identification marks in that list are often not very clear, omissions might occur inadvertently, but all who understood the tradition of the breakfast and heard it was to take place came of their own initiative.

### Address to the Sub-Section Cosmical Physics,

BY SIR JOHN ELIOT, K.C.I.E., M.A., F.R.S.

INDIA is the most typical example of monsoon conditions, that is, of opposite air movements of six-monthly period which, in its case, depend on the annual temperature changes in the sea and land areas of the Indian Ocean and continent of Asia. The monsoon conditions in India are intensified by its unique position and topography. It projects southwards into the Indian seas over 15° of latitude, and is protected northwards by the vast barrier of the Himalaya Mountain range and Tibetan plateau. The axis of the Himalayan range is at least 2000 miles in length and has an average elevation of over 20,000 feet. The extent of country over 10,000 feet in elevation to the north of India is from 300 to 500 miles in width.

These figures will give some idea of the magnitude of India's northern barrier.

During one period of the year there is an outflow in the lower atmosphere from land to sea. The direction of the lower air drift in India is determined in part by the lie of the mountains and river valleys, and is from north-east over the greater part of the Indian seas. January is the month most typical of this air movement and of the accompanying weather conditions.

During another portion of the year the lower horizontal air movement is from sea to land. This movement is much steadier and more powerful and influential in every respect than the former. July and August are the months most representative of the totality of the weather conditions of this period.

\* \* \* \* \*

The regions of rainfall indicate the areas of upward movement terminating the lower advance of the current. The circulation is undoubtedly maintained in large part by the release or addition of energy due to the condensation of its enormous stores of aqueous vapour. The lower air movement is of very considerable elevation, estimated at 15,000 to 20,000 feet in India. Above it is the outward upper return movement, in part only compensatory, and in part probably slowly filling up the Central and Southern Asian low-pressure region. The movement exhibits some interesting features in India, due to the fact that of the three areas to which it is mainly determined India alone is subject to a double influx from two sea areas in opposite directions. The current from the Arabian Sea passes eastwards across the Malabar, Konkan, and North Bombay coasts, the peninsula and Central India. The Bengal current is deflected in the north of the Bay and Bengal, and advances in a westerly direction up the Gangetic plain. Between the areas or two fields of the two currents (roughly proportional to their relative strength and importance—viz., about 2 to 1) is a debatable area of variable winds and low pressure. This trough of low pressure varies in position with the relative strengths of the two currents. The cyclonic storms of the period, which are of comparatively frequent occurrence, advance along the trough. It is hence a factor of considerable importance in determining the distribution of the rainfall of the period. The trough is purely a resultant of the peculiar conditions of the air movement, and is not the cause of that movement; in other words, it is determined by it, and does not determine it.

\* \* \* \* \*

The year in India may hence be divided into two monsoons of nearly equal length,—(a) The north-east or dry monsoon; (b) The south-west or wet monsoon.

The first terms are based on the general direction of the air movement in the Indian seas during the periods, and the second on the most prominent feature of the weather in India itself. Of an average annual total rainfall of 41 inches (according to the most trustworthy calculation), at least 85 per cent. falls during the wet season, and only 15 per cent. during the dry season.

The dry monsoon in India is subdivided into—(1.) The cold-weather period. (2.) The hot-weather period or transitional period of preparation for the south-west monsoon.

The wet monsoon is subdivided into—(1.) The south-west monsoon proper, or period of general rains. (2.) The period of the retreating south-west monsoon and gradual slow establishment of the dry monsoon.

One of the most noteworthy features of the meteorology of India is that the storms of each period—viz., the cold-weather period, the hot-weather period, and the wet monsoon—are characteristic and special to the period. They are all in the broadest sense of the word cyclonic in character; but they originate under different conditions and exhibit very different features in each of those periods.

The disturbances of the cold weather are large shallow depressions which originate in the upper humid return current of the north-east monsoon circulation, chiefly in the Persian plateau region, and which drift eastward with a slight southing across extra-tropical India. Storms do not occur south of the Deccan or peninsula-dividing ranges during this period. These storms are chiefly remarkable for the frequent development of stationary secondary depressions in the Punjab, usually of much greater intensity than the primaries; a feature of which, I believe, there is no parallel elsewhere. They are of great importance, as they give the main snow supply to the Western Himalayas and the light but general occasional rain required for the wheat and other cold-weather crops of Northern India.

The storms of the hot weather are local disturbances of very limited extent, usually in large areas of slight depression, and are occasionally of remarkable intensity and great violence. In the areas to which the local sea winds of the period extend (more especially Bengal and Assam) they occur chiefly as local thunderstorms with violent winds and brief heavy downpours of rain, but sometimes as tornadoes rivalling those of certain districts of the United States in intensity and destructiveness. In the dry interior they occur as dust-storms, usually without rain, and are most violent in the driest districts, including Sind, the Punjab, and Rajputana. Occasionally, when the convective movement is especially vigorous, they develop into hailstorms of great intensity. The rainfall accompanying these hot-weather storms is of little general agricultural value except in the tea districts of Assam and Bengal.

Finally, the wet monsoon is characterised by the frequent occurrence of cyclonic storms of every degree of intensity and of very varying extent. The great majority of them originate in sea areas of nearly uniform temperature as disturbances in a massive current highly charged with aqueous vapour and subject to large variations of intensity and extension. The more prominent features of these storms, more especially of the most violent, including the hurricane winds, excessive rainfall, and the phenomena of the central calm and the accompanying storm wave, are too well known to require description. The chief importance of these storms, of which an average of about ten (of different degrees of intensity) occurs every year during this period, arises from the manner in which they modify the distribution of the rainfall, discharging it abundantly over the districts traversed by the storms at the expense of the districts outside of their field.

The most important and variable feature of the weather in India from the practical standpoint is rainfall. Its value depends upon its amount and occurrence in relation to the needs of the staple crops. The measurement of rainfall is carried out, on a uniform system, at upwards of 2500 rain

gauge stations. The average distribution of rainfall, month by month and for each season, has been determined from the data of about 2000 stations. It should, however, be recognised that the probability that the rainfall will conform exactly to this distribution in any year is *nil*. Average rainfall charts represent a distribution about which the actual varies from district to district more or less considerably, the local variation for prolonged periods being practically compensatory. Such mean or normal data and charts are undoubtedly of value, more especially for the determination of rainfall anomalies and their relations to pressure, temperature, and other anomalies. There is apparently a tendency to assign a greater value to these charts of mean rainfall distribution than they deserve. Charts showing the amount and time distribution of the rainfall best suited for the requirements of the staple crops would—for India at least—be more interesting and valuable. This is a work that I regret has, for various reasons, not yet been carried out by the Indian Meteorological Department.

In most regions in India a moderate variation (positive or negative) in the amount of the rainfall is of comparatively small importance, more especially if the precipitation occurs in amount and at intervals suited to the requirements of the crops. During the thirty-year period 1874-1903 there were six years in which the distribution of rainfall affected to a serious extent the crop returns over large areas, and the rainfall was not compensatory. In four of these years the drought was so severe and widely spread as to occasion famine, with its attendant calamities, over large areas. Severe droughts and famines occur at very irregular intervals. A noteworthy feature is that they frequently follow in pairs separated by intervals of two to four years.

The following important inferences are based upon the preceding presentation of facts and the experience of the past thirty years :—

(1.) The lower air movement of the south-west monsoon is the northward extension of the lower movement of the south-east trades. The latter is a permanent feature of the Indo-oceanic region, and the former a periodic invasion of the Southern Asian seas and peninsulas initiated over equatorial regions and propagated northwards to the southern mountain barrier of the Central Asian plateau.

(2.) The primary factors determining this impulse across the equator (the first stage of the establishment of the south-west monsoon) are to be sought in the permanent field of the south-east trades, and are not due to actions in the heated areas of Southern or Central Asia.

(3.) The pressure conditions in the heated areas of Southern Asia and North-East Africa determine the direction, volume, and intensity of the advance over the Indian seas to what may be termed three competing areas for rainfall (*viz.*, Abyssinia, India, and Burma). These conditions are hence important factors in the third stage of the advance of the south-west monsoon current.

(4.) The movement when fully established by these actions over the Southern Asian seas and peninsulas is continued—1st, by the momentum of the lower circulation ; 2nd, by the release of energy accompanying aqueous vapour condensation ; and 3rd, by thermal actions in Southern Asia, due to direct solar activity. The termination of the lower horizontal current by vertical movement occurs irregularly over the areas of frequent heavy

rain in Southern Asia and Abyssinia, and not over a heated area in Central Asia.

(5.) The total volume of aqueous vapour brought up by this circulation not only varies in amount from month to month during the season, but also from year to year. The largest variations (seasonal and annual) depend chiefly, if not entirely, upon actions in the source of supply—viz., the Indian Ocean. If those actions determine an increased or diminished supply across the equator into the Indian seas, there is a corresponding variation in the total precipitation of the three competing areas. Amongst such causes and actions may be prolonged and untimely diversion of the south-east trades into East Africa, as in 1896, or general weakness of the air movement over the Indian Ocean, probably accompanying a displacement and decreased intensity of the southern anticyclone, as in 1899.

(6.) The relative distribution of the total rainfall in the three areas of discharge of the aqueous vapour of the monsoon currents probably depends upon the relative intensities of the pressure conditions established during the hot weather, which are continued for a part or the whole of the monsoon by actions depending on the rainfall resulting from the initial pressure conditions—an example of the persistence of meteorological conditions and actions which is a prominent feature of Indian meteorology. The total rainfall of each of the three areas may differ considerably from the normal, but there may be partial or complete compensation on the whole. Thus it is the general (but not the invariable) rule that the rainfall variations in Burma and Assam are usually inverse to those of North-Western India and also of India as a whole.

(7.) The distribution of the rainfall in any one of the three competing areas (but more especially in India as the largest) may vary widely from the normal—considerable deficiency in some areas accompanying considerable excess in others. This in India is undoubtedly due to local conditions—*e.g.*, local excess or deficiency of pressure at the commencement of the period and established during the previous hot weather. These pressure variations usually accompany abnormally prolonged and heavy snowfall, or very scanty snowfall, in the Western Himalayas.

(8.) Local or general drought in India during the south-west monsoon may hence be due to—(a) General weakness of the south-east trades circulation. (b) Diversion of an unusually large proportion of the south-east trades to South-east or East Africa during the monsoon period. (c) Larger diversion than usual of the monsoon currents to Burma or Abyssinia. (d) Very unequal distribution in India itself, due to local conditions established during the antecedent hot weather.

(9.) Scanty rainfall or drought during the dry season or north-east monsoon in Northern India results from absence or unusual feebleness of the cold weather storms which are the sources of rainfall at that time.

(10.) The most prolonged and severe droughts in North-western and Central India are due to the partial or complete failure of the rainfall of at least two seasons in succession.

(11.) As the two circulations in the Indian oceanic region have a common goal in the dry season (more especially from December to March), it is probable that variations in the strength of one circulation (more especially the larger) will modify the field and strength of the other circulation. It

appears that this relation would be shown most strongly between the southern circulation and the upper movement of the northern circulation. And, as cold weather storms are disturbances in that upper movement, it is possible—if not probable—that the larger variations in the number and intensity of the cold-weather storms and the amount of the cold weather precipitation may be related to conditions in the south-east trades regions.

(12.) There appears to be little or no relation between the position and intensity of the Central Asian anticyclone and the number of the cold-weather storms and rainfall of Northern India in any season.

The meteorology of the period 1892—1902 is of especial interest for its confirmation of the above inferences, more especially the phenomena of the variations of rainfall in India and the causes to which they are due.

The period 1895—1902 was characterised by more or less persistent deficiency of rainfall over practically the whole Indo-oceanic area (including Abyssinia). The economic results in the dry interior districts of India, South Africa, and Australia, were the same—large loss of cattle and money. The drought in Southern Asia was as marked in the north-east as in the south-west monsoon, and hence the variation was not seasonal but general.

The variations of temperature, humidity, and cloud in India during the whole period were large and in direct accordance with the rainfall. In other words, during the period 1892-94 the air was damper with lower temperature than usual, and cloud above the normal. On the other hand, from 1895 to 1902 temperature was steadily in excess; and cloud and humidity less than usual.

The most interesting feature of the meteorology of the period 1892—1902 is that the variations of the solar insolation are the inverse of those which might have been expected from the cloud and humidity data. In other words, solar radiation was in excess in the period of increased humidity and cloud, and in defect during the greater part of the period of drought, decreased humidity, and cloud.

*(To be continued).*

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### Report of Kite Committee.

*Investigation of the Upper Atmosphere by Means of Kites in co-operation with a Committee of the Royal Meteorological Society.—Third Report of the Committee, consisting of DR. W. N. SHAW (Chairman), MR. W. H. DINES (Secretary), MR. D. ARCHIBALD, MR. C. VERNON BOYS, DR. A. BUCHAN, DR. R. T. GLAZEBROOK, DR. H. R. MILL, and Professor A. SCHUSTER. (Drawn up by the Chairman and Secretary.)*

THE Committee have acted throughout in conjunction with the Committee of the Royal Meteorological Society.

Since the date of the last report an account of the observations made in the summer of 1903 has been communicated to the Royal Meteorological Society and published in their *Quarterly Journal*.

In the interval between the meeting of the Association at Southport and the beginning of June experimental observations have been made at Oxshott; kites, of which various details have been altered, have been sent up almost every day on which the wind-force equalled or exceeded six on the Beaufort

scale. The object of these experiments was to ascertain if the behaviour of the kites could be improved by alteration of shape, size, &c., more particularly with regard to uniformity of pull and stability in winds of varying force.

As regards the first of these qualities considerable improvement has been effected by arrangements which will be described subsequently.

A new form of meteorograph has been designed for kite experiments by which the records of pressure, temperature, and humidity are traced upon a revolving disc of paper instead of a drum. (See this Magazine for July, p. 109.) It is made by Mr. Hicks, of Hatton Garden, under the supervision of Mr. Dines.

From the beginning of February till June ascents were made at Oxshott on every day specified by the President of the International Aeronautical Committee unless the wind was too light for work with kites.

As reported last year, an application made by the Royal Society to the Admiralty for the loan of a vessel for experiments with kites became inoperative in consequence of the accident to the ship which their lordships intended to place at the disposal of the Committee for the purpose. At the desire of the Royal Meteorological Society the Royal Society renewed the application for the loan of a vessel with a view to experiments in the summer, and their lordships assigned H.M.S. "Seahorse," a special service vessel of 600 tons and 1,000 horse-power, for the service, under the command of Staff-Captain F. W. A. Croke, R.N., for six weeks from the middle of June. Mr. Dines visited Portsmouth to make preliminary arrangements, and the "Seahorse" arrived at Crinan on June 16th. The fitting of the winding engine was completed on June 18th, and the operations commenced on Monday, June 20th, and were continued daily until July 29th, with the exception of Sundays and the two days, July 9th and 11th, when the vessel was at Oban for the purpose of coaling. The approximate heights of the several ascents were as follows:—

| Date.   | Height reached.<br>feet. | Date.  | Height reached.<br>feet. |
|---------|--------------------------|--------|--------------------------|
| June 20 | ..... 3,250              | July 8 | ..... 5,000              |
| " 21    | ..... 4,000              | " 13   | ..... 8,500              |
| " 22    | ..... 5,340              | " 14   | ..... 1,750              |
| " 23    | ..... 3,320              | " 15   | ..... 8,060              |
| " 24    | ..... 4,100              | " 16   | ..... { 6,050            |
| " 25    | ..... 3,750              | " 16   | ..... { 6,760*           |
| " 27    | ..... 2,300              | " 18   | ..... 1,200              |
| " 28    | ..... 7,300              | " 19   | ..... 4,200              |
| " 29    | ..... 4,900              | " 20   | ..... 2,680              |
| " 30    | ..... 5,600              | " 21   | ..... 5,500              |
| July 1  | ..... 5,500              | " 22   | ..... 5,900              |
| " 2     | ..... 4,400              | " 23†  | ..... —                  |
| " 4     | ..... 6,300              | " 25   | ..... 5,310              |
| " 5     | ..... 7,200              | " 26   | ..... 5,280              |
| " 6     | ..... 5,300              | " 27†  | ..... —                  |
| " 7     | ..... 7,350              | " 28   | ..... 8,000              |

\* Afternoon.

† No ascent owing to want of wind. Persistently calm weather prevailed on and after July 18.

The Committee take this opportunity of recording their thanks to the Royal Society for their action in the matter, to the Lords of the Admiralty or the loan of the "Seahorse," and to Staff-Captain Croke and the officers

and men of his vessel for the manner in which they contributed to the carrying out of the observations. An account of the results of the experiments will be published later.

In the course of correspondence with Mr. E. W. L. Holt, of the Fishery Branch of the Irish Board of Agriculture Technical Instruction, Dr. Shaw learned that there was a prospect of occasional kite observations on board the s.s. "Helga," belonging to the Board, provided that the Department was not called upon to defray the expenses of the necessary apparatus and materials. Dr. Shaw reported the matter to the Committee, and reported, further, that if the Committee were willing to supply apparatus and gear for the experiments on the "Helga" the Meteorological Council were prepared to make arrangements with Mr. Dines to initiate the experiments and explain the method of working the apparatus.

The meeting of the Committee of Section A of the British Association formed a resolution desiring the Council to take steps to urge upon the Government the provision of means for co-operating in an organised union with the Continental nations and with India and America in the investigation of the upper air by means of balloons and kites. The decision of the Government with regard to the matter is nevertheless intimately connected with the action intended with regard to the Report of the Meteorological Grant Committee of the Treasury. The Committee's report was published in June, and refers in favourable terms to the proposed investigation, but suggests no specific grant for the purpose. The action of the Government with regard to the finding of the report has not yet been made known.

Nothing is therefore ascertained as to the prospects of an investigation of the upper air of this country upon an official basis. In the meantime Mr. Dines is likely to be able with the apparatus in hand to obtain kite observations on the fixed days of the Meteorological Committee, and to make further investigations with regard to improvements of the kites and apparatus. With regard to the latter an easy means of calibrating the meteorograph is required, and this involves the use of a suitable air-tight inclosure which might be used for similar operations in future. The Committee therefore ask for re-appointment, with a grant.

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*On Upper Currents and their Relation to the Hearing of Far Sound.*  
By JOHN M. BACON.

INVESTIGATIONS carried out during a long series of balloon ascents have revealed a very remarkable complexity in the upper air-currents which, from their nature, would escape the notice of the observer on earth. A number of light bodies, of varying sizes and differently constituted, have been prepared and allowed to float away into space at different heights and under different circumstances; and these, carefully watched, have shown the existence of minor but headlong currents, holding determined courses frequently at variance with that of the balloon. It has been proved that dominant but diverse air-streams will glide one above another in juxtaposition without commingling, and that upper currents maintaining the same level will occasionally alter their course, presumably in obedience to some configuration of the earth below; while, at all heights, ascending or

descending air-streams, greater or lesser, will obtrude themselves in a way which is often wholly unaccountable.

In a manner equally capricious, and apparently dependent on the above, sounds conveyed through the upper air will be carried sometimes to abnormal distances in directions at variance with the ground current, being borne to earth over far but favoured plots of ground, while they may pass unheard over districts which might be considered well within sound range. These results, which have been obtained largely by organised observation of the hearing of aerial bombs, will presumably account for the occasional surprisingly far travel of sound signals; or, again, their failure at short ranges.

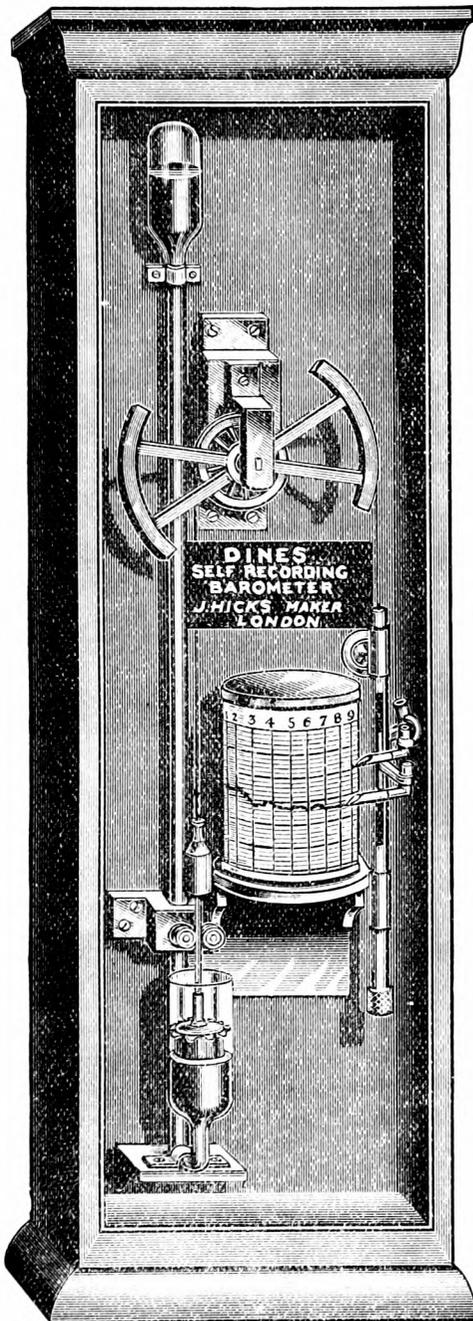


### THE DINES RECORDING BAROMETER.

THE accompanying illustration shows so clearly the mechanism of the new recording barometer devised by Mr. W. H. Dines and made by Mr. J. J. Hicks, that it is unnecessary to describe the parts in detail. It will be observed that the lower and upper cisterns are of very wide bore compared with the connecting part of the tube. The motion of the float in the lower, or open, cistern is magnified and transmitted to the pen by the system of levers shown. The second pen is at a fixed height, and draws a standard line upon the paper, so that there may be no doubt whether the chart has been correctly adjusted on the cylinder. There is only one point of difficulty: that is with regard to the application of a correction for temperature, and on this Mr. Dines has kindly supplied the following explanation:—

In a self-recording barometer when the pen is actuated by a float in the lower cistern it is easy to apply a temperature compensation, and the convenience of doing away with the necessary correction is well worth the small additional expense.

In cases where the barometer consists of an upper and a lower cistern connected by a smaller tube, the effect of a rise of temperature is to lower the level in the bottom cistern and to raise it in the upper one. The volume of mercury in the connecting tube being small, its expansion with heat has but a trifling effect upon the level in the cisterns, but owing to its decreased density, a longer column is required to balance the air pressure, and this is obtained by the mercury sinking in the lower and rising in the upper cistern. Compensation can be obtained by any plan that will raise the mercury in the cistern, or raise the float in the mercury, when the temperature rises. Either effect is easily produced. If the vacuum chamber be a large one, and sufficient air to produce a few tenths of an inch pressure be left in it, compensation by the raising of the mercury level can be obtained; and the sizes being given, the calculation of the pressure that must be left presents no difficulty.



It is perhaps more convenient to employ a float containing air, the expansion of which raises the level at which the float swims in the mercury. An inverted iron cylinder hermetically sealed at the top and floating mouth downwards serves the purpose. The length of the column of enclosed air that must be left can be obtained by calculation, and a syphon trap can be arranged which affords an exit for the air until the desired amount is left, the trap being then sealed by the mercury. An increase of temperature reduces the density of the mercury in the barometer tube, and hence lowers the level in the bottom cistern, but at the same time it expands the air in the float, and if the correct amount has been left, the total result is that there is no change in the position of the float. Of course the compensation is not theoretically perfect, since the expansion of mercury per degree is practically constant, whereas the expansion of air varies as the absolute temperature — *i.e.*, the temperature measured from  $-460^{\circ}$  F., but for all practical purposes the difference is inappreciable. The height at which the float swims

is also influenced by the barometric pressure prevailing at the time, since this also alters the volume of the enclosed air, but the result is only a small alteration in the magnitude of the scale.

## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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### THE WETTEST SPOT IN THE UNITED KINGDOM.

WITH regard to the suggestion made by Mr. Gethin-Jones in his interesting and lucid article of last month, on the wettest spot in Wales, that there may be places among the mountains of south-west Ireland possessing a higher mean annual rainfall than the Styne Head Pass, this may, of course, prove to be the fact, but it is scarcely likely to prove so, inasmuch as Cumberland lies farther into the low-pressure region of the north Atlantic than Kerry, with the consequence that during the westerly type of weather which so often prevails over the United Kingdom, a cyclonic system, situated to the north of these islands, which may be causing a deluge in Scotland and northern England, will occasion a more moderate rainfall in the south of Ireland, and perhaps only a few passing showers in the south of England. We are so accustomed to associate the distribution of rainfall in this country with the relief of the land, that we are apt to overlook the fact that some regions experience the full influence of a greater number of cyclonic systems in the course of a year than others.

The exaggerated difference between the mean annual rainfalls of two such places, for example, as the Styne Head Pass and Hampstead Heath, though primarily due to the situation of the former place in the heart of the Cumbrian mountains, is also, in some measure, to be accounted for by the fact that Middlesex is spared the ravages of a greater number of cyclones in the course of a year than Cumberland. In the relatively cold climate of England the bulk of the rain which falls is occasioned by powerful external causes, like cyclones (the actual amount of precipitation being, of course, enormously increased in the mountainous districts), and even in the south-east of England, where the summers are warmer than in any other part of Britain, the thunder rains of local origin are not remarkably pronounced, either in frequency or intensity; whereas in northern Italy, where thunder and hail storms of great severity are at times in summer of almost daily occurrence, three or four inches of rain in twenty-four hours is no unusual amount; in London the fall during the same period very rarely exceeds two inches. Thus the "home-made" summer rains of Britain that show such a tendency to develop about 3 p.m., on sultry days, are quite insignificant compared with the enormous autumn and winter precipitation of the mountainous districts of the north and west. The wettest spot in the British Isles, be it in Kerry, Carnarvon, Cumberland, Argyll or Skye, will obviously be found on the leeward side of

some mountainous mass, which, situated in a district influenced by a large number of rainy atmospheric depressions, is able to enhance in the most efficient manner the upward movement of the moisture-laden winds which strike against it.

L. C. W. BONACINA.

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### BALL LIGHTNING.

I ONCE saw ball lightning during a heavy thunderstorm at Aber, N. Wales, on 21st August, 1898. I was sitting with a friend in the porch of the Railway Hotel, watching the storm, when, at about 10 p.m., a brilliant flash revealed small balls of fire along a low line of clouds. The effect, though of course instantaneous, was very pretty.

C. S. PRINGLE.

*Whitekirk, Southbourne, Hants, August 17th, 1904.*

[The appearance described by Mr. Pringle is well-known, but is not the phenomenon usually described as ball lightning. The question in dispute is whether lightning in the form of a ball of fire enters a house or rolls along the ground, and finally bursts in a manner capable of doing damage.—ED. *S.M.M.*]

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A SHARP thunderstorm was experienced here on the 22nd inst., between 11.30 a.m. and noon. After a loud peal of thunder, a ball of light of a molten glowing yellow colour became visible in the S.E. at 11.40 a.m. The ball was estimated to be about  $\frac{1}{2}^{\circ}$  in diameter, and appeared about  $5^{\circ}$  above the surface of the sea. To the top of the ball was attached a narrow, pear-shaped appendage, extending upwards about  $1\frac{1}{2}^{\circ}$ . The ball remained visible for nearly five seconds, when it was swallowed up in a dense blue-black mist, which hung over the sea during the storm. The cumulus clouds in the early morning were remarkable for their immense size and strong electrical appearance.

SPENCER C. RUSSELL.

*Dawlish, S. Devon, August 27th, 1904.*

[At the time when this interesting discussion is going on in these pages, the above recent observation of the phenomenon cannot fail to be of interest.]

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### FORMATION OF A WATER SPOUT.

I WISH to direct your attention to a meteorological phenomenon that delighted me for a short time last Tuesday, near midday. As I travelled by train from Harrogate to Lancaster, when less than an hour from the latter place, I noticed a large cumulus cloud in the west, apparently moving slowly in an easterly direction; it was ragged below, dark and smooth-like near the middle. From what I could estimate it may have been 30 or 40 miles distant, and about

30° in depth. From about 7° or 8° above the lower edge there was distinctly seen a water spout. This soon extended down to a jagged edge of the cloud, then trailed down in front of sky with only thin whitish cloud, or with none. It soon attained a length of 7° or 8°, then it departed gradually from the perpendicular until it was finally seen as a slightly irregular tube at an angle of about 60° to 70°, the upper, attached end, travelling faster than the lower part. It must, after ten minutes, have attained a length of something like 10°, but it lengthened by assuming the form of a rat's tail, as if spun out, the lower part ending in a fine tapering point. When greatly attenuated, it broke into dissolving fragments. It was longer and thinner than any spout I ever saw in the tropics. The whole phenomenon may have lasted about a quarter of an hour.

I hope a number of holiday seekers may have levelled their kodaks on it.

W. MACGREGOR.

*Waverley Hotel, Edinburgh, August 25th, 1904.*

[We are greatly indebted to His Excellency Sir William MacGregor, the new Governor of Newfoundland, for the graphic description given above, and we hope that if a photograph of the phenomenon was secured by any fortunate observer we may be favoured with a copy of it.—ED. S.M.M.]

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### HEAVY RAIN ON AUGUST 22nd.

THE rainfall of Monday, August 22nd, amounted to exactly 2 inches. A thunderstorm came up from the south, rain beginning at 2 p.m., by 4.30 rain had ceased, 1.33 in. having fallen. Rain fell at intervals through the evening, and another short thunderstorm occurred from 8 to 8.30 p.m. The afternoon storm was quite local, and no rain fell at Witham till 4 p.m., while the rain here was heaviest about 3 p.m., accompanied by two short falls of hail.

H. C. BOUTFLOWER.

*Terling Vicarage, Witham, August 29th, 1904.*

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### METEOROLOGICAL NEWS AND NOTES.

THE AUSTRIAN METEOROLOGICAL SOCIETY has received from the Emperor of Austria the right to use the letters "K.K.," equivalent to Royal Imperial, before its name, so that its official designation now becomes the "k.k.Oesterreichische Gesellschaft für Meteorologie." This Society and the German Meteorological Society are jointly responsible for the *Meteorologische Zeitschrift* so ably edited by Drs. Hann and Hellmann.

## THE EIGHT MONTHS' RAINFALL OF 1904.

*Aggregate Rainfall for January—August, 1904.*

| Stations.             | Total Rain. | Per cent. of Aver. | Stations.           | Total Rain. | Per cent. of Aver. | Stations.         | Total Rain. | Per cent. of Aver. |
|-----------------------|-------------|--------------------|---------------------|-------------|--------------------|-------------------|-------------|--------------------|
|                       | in.         |                    |                     | in.         |                    |                   | in.         |                    |
| London .....          | 14·44       | 103                | Arncliffe .....     | 40·02       | 107                | Braemar .....     | 18·31       | 88                 |
| Tenterden .....       | 16·36       | 101                | Hull .....          | 16·11       | 105                | Aberdeen .....    | 18·56       | 96                 |
| Hartley Wintney ..... | 17·11       | 112                | Newcastle.....      | 16·36       | 102                | Cawdor .....      | 15·69       | 83                 |
| Hitchin .....         | 15·92       | 112                | Seathwaite .....    | 85·76       | 109                | Glencarron .....  | 54·71       | 98                 |
| Winslow .....         | 16·61       | 115                | Cardiff .....       | 29·67       | 127                | Dunrobin .....    | 18·69       | 101                |
| Westley .....         | 15·08       | 97                 | Haverfordwest ..... | 26·96       | 109                | Killarney .....   | 35·50       | 107                |
| Brundall.....         | 13·97       | 91                 | Gogerddan .....     | 29·69       | 116                | Waterford .....   | 29·07       | 120                |
| Alderbury .....       | 19·95       | 123                | Llandudno .....     | 18·69       | 108                | Broadford.....    | 26·75       | 128                |
| Ashburton .....       | 37·30       | 131                | Dumfries .....      | 27·28       | 103                | Carlou .....      | 23·43       | 111                |
| Polapit Tamar .....   | 30·24       | 142                | Lilliesleaf .....   | 21·79       | 117                | Dublin .....      | 16·82       | 98                 |
| Stroud .....          | 20·27       | 121                | Colmonell .....     | 27·12       | 104                | Mullingar .....   | 24·20       | 104                |
| Woolstaston .....     | 20·11       | 113                | Glasgow .....       | 24·25       | 110                | Ballinasloe ..... | 27·21       | 119                |
| Boston .....          | 13·76       | 110                | Inveraray .....     | 45·37       | 107                | Clifden .....     | 56·52       | 116                |
| Hesley Hall .....     | 15·90       | 122                | Islay .....         | 32·05       | 122                | Crossmolina ..... | 42·56       | 137                |
| Derby .....           | 15·05       | 105                | Mull .....          | 39·11       | 117                | Seaforde .....    | 24·59       | 110                |
| Bolton .....          | 23·10       | 91                 | Loch Leven .....    | 24·72       | 112                | Londonderry..     | 28·47       | 112                |
| Wetherby .....        | 20·26       | 137                | Dundee .....        | 19·25       | 114                | Omagh .....       | 30·12       | 124                |

The fairly normal character of the rainfall during August, especially over England and Wales, leaves the general distribution of the areas of excess and deficiency very similar to that shown in the aggregate table ending July. The excess of rainfall accumulated in the early months of the year was to some extent neutralized by the dryness of June, and in a lesser degree July, but the percentages generally speaking are in the present table again showing a slight increase. Certain individual stations have been more disturbed, notably in the case of Dundee, which from a deficit of 3 per cent. at the end of July had advanced to an excess of 14 per cent. by the end of August. The south-west of England remains relatively the wettest part of the United Kingdom, but with slightly reduced values. The north-east of Scotland also maintains its position as the driest portion of our islands, though the area is probably somewhat reduced. The only other parts of the British Isles reporting a deficiency are the east of England and isolated patches in the neighbourhood of Bolton and Dublin, the deficit in the last-named instance being so small as to be almost negligible. Compared with the corresponding period of 1903 only three stations in the present table give values exceeding that year, one being in the south-west of England and two in the west of Ireland, and taking the country as a whole the value is found to be 111 per cent. of the average as against 139 per cent. in 1903, the average used being that for the decade 1890-99, which, it should be borne in mind, is considerably lower than the mean for a longer period.

RAINFALL AND TEMPERATURE, AUGUST, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.      |                                   |                          |       | Days on which<br>-01 or more fell. | TEMPERATURE. |       |      |        | No. of<br>Nights<br>below<br>32°. |       |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------|--------------------------|-------|------------------------------------|--------------|-------|------|--------|-----------------------------------|-------|
|        |                                                                                                                                      | Total<br>Fall. | Diff. from<br>average,<br>1890-9. | Greatest in<br>24 hours. |       |                                    | Max.         |       | Min. |        | Shade                             | Grass |
|        |                                                                                                                                      |                |                                   | Depth                    | Date. |                                    | Deg.         | Date. | Deg. | Date.  |                                   |       |
| I.     | London (Camden Square) ...                                                                                                           | 1.59           | — .51                             | .75                      | 31    | 10                                 | 91.0         | 4     | 44.3 | 21     | 0                                 | 0     |
| II.    | Tenterden.....                                                                                                                       | 1.18           | — 1.26                            | .54                      | 31    | 11                                 | 87.0         | 4     | 43.5 | 21     | 0                                 | 0     |
|        | Hartley Wintney .....                                                                                                                | 2.04           | — .31                             | .72                      | 31    | 8                                  | 85.0         | 3, 4  | 39.0 | 26     | 0                                 | 0     |
| III.   | Hitchin.....                                                                                                                         | 2.51           | + .38                             | 1.08                     | 31    | 12                                 | 85.0         | 4     | 42.0 | 20     | 0                                 | 0     |
|        | Winslow (Addington) .....                                                                                                            | 2.68           | + .55                             | 1.00                     | 31    | 11                                 | 87.0         | 4     | 37.0 | 25     | 0                                 | 0     |
| IV.    | Bury St. Edmunds (Westley) .....                                                                                                     | 2.67           | + .27                             | 1.54                     | 31    | 10                                 | 87.0         | 4     | 40.0 | 25     | 0                                 | 0     |
|        | Brundall .....                                                                                                                       | 2.17           | — .20                             | .59                      | 21    | 13                                 | 87.6         | 4     | 42.0 | 21     | 0                                 | 0     |
| V.     | Alderbury .....                                                                                                                      | 2.49           | + .28                             | .53                      | 22    | 13                                 | 79.0         | 3     | 39.0 | 24     | 0                                 | 0     |
|        | Winterborne Steepleton ...                                                                                                           | 3.82           | ...                               | .62                      | 16    | 17                                 | 77.8         | 3     | 39.4 | 13     | 0                                 | 0     |
|        | Torquay (Cary Green) .....                                                                                                           | 2.87           | ...                               | .76                      | 16    | 14                                 | 76.5         | 4     | 48.0 | 21, 24 | 0                                 | 0     |
|        | Polapit Tamar [Launceston] .....                                                                                                     | 2.32           | — 1.02                            | .44                      | 21    | 16                                 | 75.7         | 3     | 36.0 | 24     | 0                                 | 0     |
|        | Bath .....                                                                                                                           | 2.82           | ...                               | .59                      | 22    | 14                                 | 82.0         | 3     | 40.2 | 25     | 0                                 | 2     |
| VI.    | Stroud (Upfield) .....                                                                                                               | 2.80           | + .26                             | .81                      | 21    | 17                                 | 82.0         | 3     | 44.0 | 24     | 0                                 | 0     |
|        | Church Stretton (Woolstaston) .....                                                                                                  | 3.19           | + .35                             | .70                      | 3     | 16                                 | 78.0         | 3     | 42.0 | 23     | 0                                 | 0     |
|        | Bromsgrove (Stoke Reformatory) .....                                                                                                 | 1.62           | + .33                             | .45                      | 3     | 12                                 | 81.0         | 3     | 35.0 | 24     | 0                                 | 0     |
| VII.   | Boston .....                                                                                                                         | 1.75           | — .20                             | .54                      | 11    | 11                                 | 87.0         | ...   | 41.0 | ...    | 0                                 | 0     |
|        | Bawtry (Hesley Hall) .....                                                                                                           | 2.91           | + .70                             | 1.21                     | 17    | 13                                 | 85.0         | 4, 5  | 51.0 | 23     | 0                                 | 0     |
|        | Derby (Midland Railway) ...                                                                                                          | 2.67           | + .55                             | 1.00                     | 17    | 15                                 | 88.0         | 3     | 41.0 | 24     | 0                                 | 0     |
| VIII.  | Bolton (The Park) .....                                                                                                              | 4.64           | + .16                             | .72                      | 22    | 22                                 | 80.2         | 3     | 43.2 | 21     | 0                                 | 0     |
| IX.    | Wetherby (Ribston Hall) ...                                                                                                          | 3.75           | + 1.48                            | 1.13                     | 17    | 16                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
|        | Arncliffe Vicarage .....                                                                                                             | 5.76           | + .27                             | .97                      | 17    | 24                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
|        | Hull (Pearson Park) .....                                                                                                            | 3.28           | + .66                             | 1.24                     | 17    | 19                                 | 84.0         | 3     | 38.0 | 21     | 0                                 | 0     |
| X.     | Newcastle (Town Moor) ...                                                                                                            | 2.59           | — .32                             | .90                      | 22    | 19                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
|        | Borowdale (Seathwaite) ...                                                                                                           | 11.09          | — .31                             | 2.00                     | 14    | 22                                 | 76.5         | 29    | 36.0 | 21     | 0                                 | 0     |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 3.47           | — .70                             | .63                      | 22    | 21                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
|        | Haverfordwest (High St.) ...                                                                                                         | 2.93           | — .73                             | .90                      | 12    | 10                                 | 83.6         | 10    | 40.2 | 8      | 0                                 | 0     |
|        | Aberystwith (Gogerddan) ...                                                                                                          | 6.86           | + 2.91                            | 1.60                     | 16    | 16                                 | 87.0         | 24    | 30.0 | 17     | 1                                 | 0     |
|        | Llandudno .....                                                                                                                      | 3.26           | + .46                             | .70                      | 21    | 17                                 | 78.0         | 4     | 45.0 | 25     | 0                                 | 0     |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 3.84           | — .30                             | .84                      | 13    | 16                                 | 77.0         | 30    | 37.0 | 21     | 0                                 | 0     |
| XIII.  | Edinburgh (Royal Observy.) .....                                                                                                     | 4.30           | ...                               | 1.15                     | 17    | 18                                 | 75.1         | 4     | 42.5 | 21     | 0                                 | 0     |
| XIV.   | Colmonell .....                                                                                                                      | 5.81           | + 1.82                            | 1.65                     | 10    | 19                                 | 75.6         | 30    | 38.0 | 23     | 0                                 | 0     |
| XV.    | Tighnabruach .....                                                                                                                   | 5.03           | ...                               | .67                      | 10    | 21                                 | 66.0         | 30    | 40.0 | 22b    | 0                                 | 0     |
|        | Mull (Quinish) .....                                                                                                                 | 5.84           | + .72                             | .88                      | 3     | 22                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 5.69           | + 2.03                            | .79                      | 5     | 21                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
|        | Dundee (Eastern Necropolis) .....                                                                                                    | 5.55           | + 2.74                            | 1.40                     | 4     | 24                                 | 77.7         | 4     | 41.9 | 20     | 0                                 | 0     |
| XVII.  | Braemar .....                                                                                                                        | 3.73           | + .06                             | .72                      | 4     | 21                                 | 72.0         | 4     | 34.0 | 25     | 0                                 | 6     |
|        | Aberdeen (Cranford) .....                                                                                                            | 2.31           | — .99                             | .31                      | 6     | 22                                 | 77.0         | 29    | 36.0 | 24     | 0                                 | 0     |
|        | Cawdor (Budgate) .....                                                                                                               | 4.04           | + .89                             | .79                      | 4     | 24                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
| XVIII. | Glencarron Lodge .....                                                                                                               | 9.27           | + .73                             | 1.36                     | 6     | 28                                 | 77.6         | 30    | 36.5 | 25     | 0                                 | 0     |
|        | Bendamph .....                                                                                                                       | 7.10           | + .38                             | 1.09                     | 13    | 25                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
| XIX.   | Dunrobin Castle .....                                                                                                                | 3.03           | + .48                             | .65                      | 13    | 20                                 | 69.0         | 4     | 38.0 | 25     | 0                                 | 0     |
|        | Castletown .....                                                                                                                     | 3.06           | ...                               | .59                      | 13    | 28                                 | 76.0         | 3     | 36.0 | 25     | 0                                 | 0     |
| XX.    | Killarney .....                                                                                                                      | 4.02           | — 1.30                            | .82                      | 14    | 19                                 | 76.0         | 30    | 41.5 | 24     | 0                                 | 0     |
|        | Waterford (Brook Lodge) ...                                                                                                          | 4.18           | + .25                             | .74                      | 30    | 17                                 | 69.5         | 4     | 40.0 | 16     | 0                                 | 0     |
|        | Broadford (Hurdlestown) ...                                                                                                          | 4.24           | + .66                             | .64                      | 3     | 23                                 | 68.0         | 29a   | 42.0 | 22, 23 | 0                                 | 0     |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 4.10           | + .67                             | .86                      | 21    | 18                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
|        | Dublin (Fitz William Square) .....                                                                                                   | 2.90           | — .06                             | .90                      | 30    | 18                                 | 77.7         | 3     | 44.6 | 24     | 0                                 | 0     |
| XXII.  | Ballinasloe .....                                                                                                                    | 4.82           | + .89                             | 1.34                     | 1     | 25                                 | 74.0         | 30    | 39.0 | 16     | 0                                 | 0     |
|        | Clifden (Kylemore House) ..                                                                                                          | 6.63           | — 1.27                            | 1.25                     | 5     | 22                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
| XXIII. | Seaforde .....                                                                                                                       | 4.73           | + 1.43                            | 1.02                     | 10    | 22                                 | 79.0         | 5     | 43.0 | 22     | 0                                 | 0     |
|        | Londonderry (Creggan Res.) ..                                                                                                        | 7.33           | + 2.91                            | 1.05                     | 30    | 25                                 | ...          | ...   | ...  | ...    | ...                               | ...   |
|        | Omagh (Edenfel) .....                                                                                                                | 5.37           | + 1.13                            | .96                      | 10    | 24                                 | 73.0         | 30    | 41.0 | 22     | 0                                 | 0     |

+ Shows that the fall was above the average; — that it was below it. a and 30 31. b and 23, 24.

## SUPPLEMENTARY RAINFALL, AUGUST, 1904.

| Div.  | STATION.                       | Rain.<br>inches | Div.   | STATION.                      | Rain.<br>inches |
|-------|--------------------------------|-----------------|--------|-------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....    | 2·09            | XI.    | New Radnor, Ednol .....       | 3·68            |
| „     | Sheppey, Leysdown .....        | 2·18            | „      | Rhayader, Nantgwillt .....    | 3·86            |
| „     | Hailsham .....                 | 2·00            | „      | Lake Vyrnwy .....             | 5·61            |
| „     | Crowborough .....              | 1·69            | „      | Ruthin, Plâs Drâw.....        | 3·78            |
| „     | Ryde, Beldornie Tower.....     | 2·38            | „      | Criccieth, Talarvor.....      | 3·91            |
| „     | Emsworth, Redlands.....        | 2·95            | „      | Anglesey, Lligwy .....        | 2·74            |
| „     | Alton, Ashdell .....           | 2·88            | „      | Douglas, Woodville .....      | 4·21            |
| „     | Newbury, Welford Park ...      | 3·10            | XII.   | Stoneykirk, Ardwell House     | 4·76            |
| III.  | Harrow Weald .....             | 2·17            | „      | Dalry, Old Garroch .....      | 7·88            |
| „     | Oxford, Magdalen College..     | 1·48            | „      | Langholm, Drove Road....      | 5·63            |
| „     | Banbury, Bloxham... ..         | 1·77            | „      | Moniave, Maxwellton House     | 5·74            |
| „     | Pitsford, Sedgebrook .....     | 3·18            | „      | Lilliesleaf, Riddell .....    | 2·85            |
| „     | Huntingdon, Brampton.....      | 1·31            | XIII.  | N. Esk Reservoir [Penicuick]  | 4·50            |
| „     | Wisbech, Bank House .....      | 2·08            | XIV.   | Maybole, Knockdon Farm..      | 4·90            |
| IV.   | Southend .....                 | 1·80            | „      | Glasgow, Queen's Park .....   | 3·45            |
| „     | Colchester, Lexden.....        | 1·30            | XV.    | Inveraray, Newtown .....      | 7·41            |
| „     | Saffron Waldon, Newport... ..  | 2·46            | „      | Ballachulish, Ardsheal .....  | 8·12            |
| „     | Rendlesham Hall .....          | ·83             | „      | Campbeltown, Redknowe... ..   | 4·97            |
| „     | Swaffham .....                 | 3·38            | „      | Islay, Eallabus .....         | 5·41            |
| „     | Blakeney .....                 | 1·63            | XVI.   | Dollar .....                  | 5·61            |
| V.    | Bishop's Cannings .....        | 2·96            | „      | Balquhider, Stronvar .....    | 7·74            |
| „     | Ashburton, Druid House ...     | 3·40            | „      | Coupar Angus Station .....    | 4·34            |
| „     | Okehampton, Oaklands.....      | 2·99            | „      | Blair Atholl.....             | 4·13            |
| „     | Hartland Abbey .....           | 3·06            | „      | Montrose, Sunnyside.....      | 4·19            |
| „     | Lynmouth, Rock House ...       | 2·99            | XVII.  | Alford, Lynturk Manse ...     | 3·04            |
| „     | Probus, Lamellyn .....         | 2·40            | „      | Keith, H.R.S. ....            | 5·14            |
| „     | Wellington, The Avenue ...     | 2·76            | XVIII. | Fearn, Lower Pitkerrie.....   | 3·36            |
| „     | North Cadbury Rectory ..       | 3·27            | „      | S. Uist, Askernish .....      | ...             |
| VI.   | Clifton, Pembroke Road ...     | 3·23            | „      | Invergarry .....              | 4·53            |
| „     | Moreton-in-Marsh, Longboro'    | 2·67            | „      | Aviemore, Alvie Manse.....    | 3·67            |
| „     | Ross, The Graig .....          | 1·77            | „      | Loch Ness, Drumnadrochit.     | 3·28            |
| „     | Shifnal, Hatton Grange.....    | 2·75            | XIX.   | Invershin .....               | 3·68            |
| „     | Wem Rectory .....              | 4·60            | „      | Altnaharra .....              | 2·17            |
| „     | Cheadle, The Heath House.      | 4·86            | „      | Bettyhill .....               | 4·98            |
| „     | Coventry, Kingswood .....      | 1·69            | „      | Watten, H.R.S. ....           | 2·87            |
| VII.  | Market Overton .....           | 2·08            | XX.    | Cork, Wellesley Terrace ...   | 2·97            |
| „     | Market Rasen .....             | 5·62            | „      | Darrynane Abbey .....         | 4·78            |
| „     | Worksop, Hodsock Priory..      | 3·45            | „      | Glenam [Clonmel] .....        | 3·53            |
| VIII. | Neston, Hinderton.....         | 4·18            | „      | Ballingarry, Hazelfort .....  | 3·58            |
| „     | Southport, Hesketh Park... ..  | 3·10            | „      | Miltown Malbay.....           | 6·01            |
| „     | Chatburn, Middlewood .....     | 6·58            | XXI.   | Gorey, Courtown House ...     | 2·77            |
| „     | Duddon Valley, Seathwaite Vic. | 5·15            | „      | Moynalty, Westland .....      | 3·67            |
| IX.   | Langsett Moor, Up. Midhope     | ...             | „      | Athlone, Twyford .....        | 5·26            |
| „     | Baldersby .....                | 3·04            | „      | Mullingar, Belvedere.....     | 2·88            |
| „     | Scalby, Silverdale .....       | 3·44            | XXII.  | Woodlawn .....                | 4·39            |
| „     | Ingleby Greenhow .....         | 3·43            | „      | Westport, Murrisk Abbey..     | 5·47            |
| „     | Middleton, Mickleton .....     | 2·80            | „      | Crossmolina, Enniscoe .....   | 6·98            |
| X.    | Beltingham .....               | ...             | „      | Collooney, Markree Obsy... .. | 6·05            |
| „     | Bamburgh.....                  | ...             | XXIII. | Enniskillen, Portora .....    | 4·35            |
| „     | Keswick, The Bank .....        | 5·14            | „      | Warrenpoint .....             | 5·74            |
| „     | Melmerby Rectory .....         | 3·30            | „      | Banbridge, Milltown .....     | 5·77            |
| XI.   | Llanfrechfa Grange.....        | 5·13            | „      | Belfast, Springfield .....    | 4·90            |
| „     | Treherbert, Tyn-y-waun ...     | 6·52            | „      | Bushmills, Dundarave .....    | 5·52            |
| „     | Llandoverly, Tonn .....        | 3·42            | „      | Stewartstown .....            | 5·22            |
| „     | Castle Malgwyn .....           | 2·85            | „      | Killybegs .....               | 4·81            |
| „     | Llandefaelog-fach .....        | 3·13            | „      | Horn Head .....               | 4·51            |

## METEOROLOGICAL NOTES ON AUGUST, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

## ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Changeable and never settled for more than a few days together. Hot weather during the first and last weeks. The R was of little consequence until the last day, and little T or L occurred. Duration of sunshine 199·6 hours,\* and of R 31·5 hours, of which 15·5 hours occurred on 31st. Mean temp. 62°·6, or 0°·5 above the average.

ABINGER HALL.—Dry, with cold nights. R was much needed and grass lands very brown and dried up. The fall on the 31st was most welcome.

TENTERDEN.—Very dry till 31st. Several hot days in the first and last weeks. High wind on 14th and 15th, doing great damage to hops and fruit. Pastures much burnt up.

CROWBOROUGH.—The first four days were very warm, but the remainder cooler and very pleasant. R much below the average.

HARTLEY WINTNEY.—A perfect summer month, beautiful R alternating with lovely sunshine. Absence of T, and clear warm nights. Ozone on 15 days with a mean of 3·5.

PITSFORD.—A pleasant month, excellent for harvest operations. A considerable amount of wind. R 1·31 in. above the average. Mean temp. 59°·0.

COLCHESTER.—Dry, with much sunshine and several hot days. Cool from 11th to 25th.

BURY ST. EDMUNDS.—Very hot and dry till the last day, when 1·54 in. of R fell. Splendid for the harvest, which was completed in first-rate condition.

BRUNDALL.—Hot and dry at first, followed by a cool and unsettled period, with some sharp TSS. Splendid weather in the last week with increased heat, breaking into T and R again at the close. Mean temp. 0°·3 above the average.

TORQUAY.—R 20 in. above the average. Duration of sunshine 233·2 hours\* or 27·5 hours above the average. Mean temp. 60°·7 or 0°·9 below the average. Mean amount of ozone 4·5. Max. 7·0 on 18th, with W.N.W. wind; min. 2·0 on 5th, with S.W. wind.

POLAPIT TAMAR.—Generally very seasonable, though the night temp. was low.

NORTH CADBURY.—Good summer weather for the first ten days; after that cool, showery and autumnal, with never more than three fine days together and R well above the average.

ROSS.—Generally very fine but frequent slight showers. No heavy storms. R below the average, but temp. normal, being highest in the first and last weeks. Harvest, both hay and corn, was almost all secured in excellent condition.

WORKSOP.—Fine, except for heavy R between 17th and 23rd. Harvest was about finished by the end of the month.

BOLTON.—On the whole favourable for agriculture.\* The mean temp., 56°·2, was 0°·4 below the average, and the R just about normal. Duration of sunshine 150·8 hours\* or 25·9 hours above the average. From 1st to 5th, and again from 28th to 30th, the mean temp. exceeded 60° for the first time in August since 1899. Nearly all the harvest was gathered in excellent condition.

SOUTHPORT.—A fairly normal month, bar. pressure being, however, rather high. Mean temp. 0°·1 below, duration of sunshine 7 hours below, and R 67 in. below, the average.

HULL.—After the passing of the heat wave some unsettled weather ensued, lasting till 25th, when it became hot again till the end. Duration of sunshine 161·3 hours. On 17th 1·24 in. of R fell in 14 hours.

**LLANFRECHFA GRANGE.**—Wheat ripened early and well, and most of the harvest was secured during the month.

**LLANDOVERY.**—Changeable temp. and weather. Only two days without sun, but 11 without R. R about the average.

**HAVERFORDWEST.**—Fine and warm during the first 8 days, then cooler till 22nd when the max. only reached 58°·6; warmer to the end. The temp. reached 70° on 8 days during the month.

**DOUGLAS.**—On the whole better than the normal. There were a few warm days, reaching 70°, early in the month and towards the close; otherwise generally cold. Severe gale on 6th, and strong winds on 8 days.

### SCOTLAND.

**LANGHOLM.**—R ·23 in. above the average of 28 years.

**MAXWELTON HOUSE.**—Fine and warm. A heavy hay crop was well got in, and there was plenty of grass and aftermath.

**LILLIESLEAF.**—Cold and rainy up to the last three days. R ·06 in. above the average. Crops were looking well but backward, owing to the small amount of sunshine. Harvest not commenced.

**COLMONELL.**—Generally wet, with frequent strong winds. H, T and L on 22nd.

**INVERARAY.**—On the whole very pleasant weather, but not warm except on one or two days.

**QUINISH.**—Very warm and much finer than the total R indicates, as it fell heavily and was soon over.

**COUPAR ANGUS.**—The first and last weeks were warm and the middle cold. Mean temp. 55°·9, or equal to the average. R an inch above the average. Two TSS.

**DRUMNADROCHIT.**—R ·36 in., and rainy days 5, above the average of 18 years.

**WATTEN.**—Cloudy, mild and fine, with light R and no flooding. A month of fine growing weather.

**CASTLETOWN.**—Warm and damp throughout with occasional bursts of bright, warm sunshine and drying winds, giving an opportunity for securing hay crops. On the morning of the 30th ·16 in. of R fell in 15 minutes. There was a scarcity of water in village wells from August 12th to September 3rd.

### IRELAND.

**CORK.**—R ·52 in. less than the average and mean temp. 3°·5 below the average.

**DARRYNANE.**—A tolerably good month with some fine hot days. R slightly above the average.

**MILTOWN MALBAY.**—The first half was warm, with much R; the second more sultry, with less R, but on the whole a rainy month.

**DUBLIN.**—Showery, but very favourable, with frequent high day temp., the max. rising to 70° or upwards on 9 days. Gales on four days; TS on 17th. Duration of sunshine 186·5 hours.

**MARKREE OBSERVATORY.**—Very bad weather throughout, even worse than in 1903. R fell on 25 days, at times very heavily, with strong winds.

**OMAGH.**—This year formed no exception to the typical wetness of the "Lammas" period, for from July 18th to August 18th R fell more or less heavily on every day but two, 7·47 in. in all; but probably the excess of wet was attended with less damage and discomfort than the abnormal drought prevalent at so many English and continental stations during the same period.

Climatological Table for the British Empire, March, 1904.

| STATIONS.<br><br>(Those in italics are South of the Equator.) | Absolute. |       |          |                 | Average. |       |            |                     | Absolute.    |                | Total Rain. |       | Aver.  |
|---------------------------------------------------------------|-----------|-------|----------|-----------------|----------|-------|------------|---------------------|--------------|----------------|-------------|-------|--------|
|                                                               | Maximum.  |       | Minimum. |                 | Max.     | Min.  | Dew Point. | Humidity.           | Max. in Sun. | Min. on Grass. | Depth.      | Days. | Cloud. |
|                                                               | Temp.     | Date. | Temp.    | Date.           |          |       |            |                     |              |                |             |       |        |
| London, Camden Square                                         | 61·0      | 9     | 27·9     | 17              | 47·9     | 34·5  | 36·5       | <sup>0-100</sup> 87 | 96·4         | 20·9           | inches      | 15    | 7·0    |
| Malta.....                                                    | 69·8      | 17    | 44·3     | 5               | 63·1     | 51·5  | 47·4       | 72                  | 119·8        | 38·9           |             | 6     | 3·7    |
| Lagos, W. Africa .....                                        | 92·0      | 10    | 71·5     | 28              | 88·0     | 74·6  | 74·3       | 71                  | 148·0        | 68·5           |             | 9     | 5·3    |
| Cape Town .....                                               | 96·6      | 20    | 42·5     | 31              | 76·4     | 58·2  | 55·4       | 68                  | ...          | ...            |             | 7     | 3·9    |
| Durban, Natal .....                                           | 88·4      | 26    | 61·6     | 19              | 82·2     | 66·5  | ...        | ...                 | 143·3        | ...            |             | 15    | 5·4    |
| Mauritius.....                                                | 87·3      | 14    | 67·8     | 6               | 83·3     | 71·9  | 70·1       | 80                  | 154·2        | 60·8           |             | 22    | 7·1    |
| Calcutta.....                                                 | 100·0     | 28    | 61·9     | 12              | 92·1     | 69·4  | 64·6       | 62                  | 153·6        | 58·4           |             | 2     | 1·6    |
| Bombay.....                                                   | 94·7      | 30    | 69·4     | 11              | 86·7     | 73·5  | 69·1       | 71                  | 141·2        | 60·1           |             | 1     | 1·2    |
| Madras .....                                                  | 93·3      | 20    | 67·7     | 10              | 88·2     | 70·0  | 69·7       | 76                  | 143·0        | 63·8           |             | 0     | 1·2    |
| Kodaikanal .....                                              | 72·1      | 20    | 47·2     | 1               | 69·6     | 50·4  | 38·0       | 45                  | 139·6        | 34·5           |             | 1     | 2·4    |
| Colombo, Ceylon.....                                          | 91·0      | 5     | 71·6     | 11              | 88·3     | 74·2  | 71·8       | 77                  | 153·2        | 68·2           |             | 5     | 3·2    |
| Hongkong.....                                                 | 78·6      | 27    | 52·2     | 19              | 67·0     | 60·3  | 59·7       | 87                  | 122·9        | ...            |             | 15    | 9·7    |
| Melbourne.....                                                | 79·2      | 31    | 41·7     | 24              | 68·3     | 52·7  | 52·3       | 78                  | 141·9        | 33·4           |             | 8     | 6·6    |
| Adelaide .....                                                | 96·2      | 14    | 51·0     | 8               | 78·5     | 56·9  | 49·2       | 53                  | 144·6        | 45·4           |             | 4     | 4·3    |
| Coolgardie .....                                              | 97·6      | 24    | 51·4     | 21 <sup>a</sup> | 81·2     | 57·4  | 49·0       | 48                  | 164·0        | 47·2           |             | 4     | 3·6    |
| Sydney .....                                                  | 78·4      | 16    | 57·8     | 28              | 72·8     | 61·6  | 58·8       | 78                  | 121·9        | 49·1           |             | 23    | 5·8    |
| Wellington .....                                              | 73·4      | 10    | 47·0     | 26 <sup>b</sup> | 66·3     | 54·6  | 41·2       | 50                  | 132·0        | 42·5           |             | 17    | 7·2    |
| Auckland .....                                                | 75·0      | 6     | 50·5     | 20              | 69·5     | 58·8  | 56·1       | 76                  | 141·0        | 45·0           |             | 14    | 5·6    |
| Jamaica, Negril Point..                                       | 87·3      | 17    | 64·1     | 9               | 83·5     | 67·1  | 68·5       | 80                  | ...          | ...            |             | 10    | ...    |
| Trinidad .....                                                | 89·0      | 14    | 72·0     | 13              | 85·2     | 66·3  | 70·9       | 86                  | 166·0        | 59·0           |             | 15    | ...    |
| Grenada.....                                                  | 84·6      | 11    | 69·4     | 22 <sup>c</sup> | 81·7     | 70·9  | 69·4       | 76                  | 150·2        | ...            |             | 19    | 3·9    |
| Toronto .....                                                 | 50·7      | 25    | 4·2      | 4               | 35·4     | 22·0  | 24·7       | 80                  | 101·7        | -2·0           |             | 17    | 3·6    |
| Fredericton .....                                             | 51·8      | 26    | - 9·7    | 5               | 39·1     | 14·0  | 13·5       | 56                  | ...          | ...            |             | 14    | 5·4    |
| Winnipeg .....                                                | 42·5      | 30    | -23·5    | 26              | 23·3     | 2·2   | ...        | ...                 | ...          | ...            |             | 12    | 5·5    |
| Victoria, B.C. ....                                           | 52·0      | 31    | 27·8     | 1               | 45·2     | 36·8  | ...        | ...                 | ...          | ...            |             | 20    | 8·0    |
| Dawson .....                                                  | 38·0      | 26    | -38·8    | 4               | 10·0     | -15·1 | ...        | ...                 | ...          | ...            |             | 2     | 3·9    |

a and 22. b and 27 c and 24

MALTA.—Mean temp. of air 56°·7 or 0°·9 above, mean hourly velocity of wind 10·9 miles or 1·1 below, averages. Mean temp. of sea 61°·0. TSS on 3 days.

Mauritius.—Mean temp. of air 1°·4 below, dew point 0°·4 below, and R 4·84 in. above averages. Mean hourly velocity of wind 11·1 miles or 0·7 below average; extremes, 44·2 on 21st and 1·7 on 24th.

MADRAS.—Bright sunshine 271·2 hours, or 72·9 per cent. of possible.

KODAIKANAL.—Bright sunshine 264 hours.

COLOMBO.—Mean temp. 81°·7 or 0°·3 below, dew point 1°·1 below, and R 1·59 in. above, averages. Mean hourly velocity of wind 6 miles; prevailing direction S. W.

HONGKONG.—Mean temp. of air 63°·2. Bright sunshine 29·7 hours. Mean hourly velocity of wind 14·6 miles.

Adelaide.—Mean temp. of air 2°·7 below, R ·67 in. below, averages.

Sydney.—Mean temp. 2°·1 below, humidity 2·8 above, and R ·08 in. below, averages.

Wellington.—Mean temp. of air 1°·3 above, R 7·99 in. above, averages.

Auckland.—Mean temp. of air about the average, and R more than three times the average. Heavy gale on 19th.

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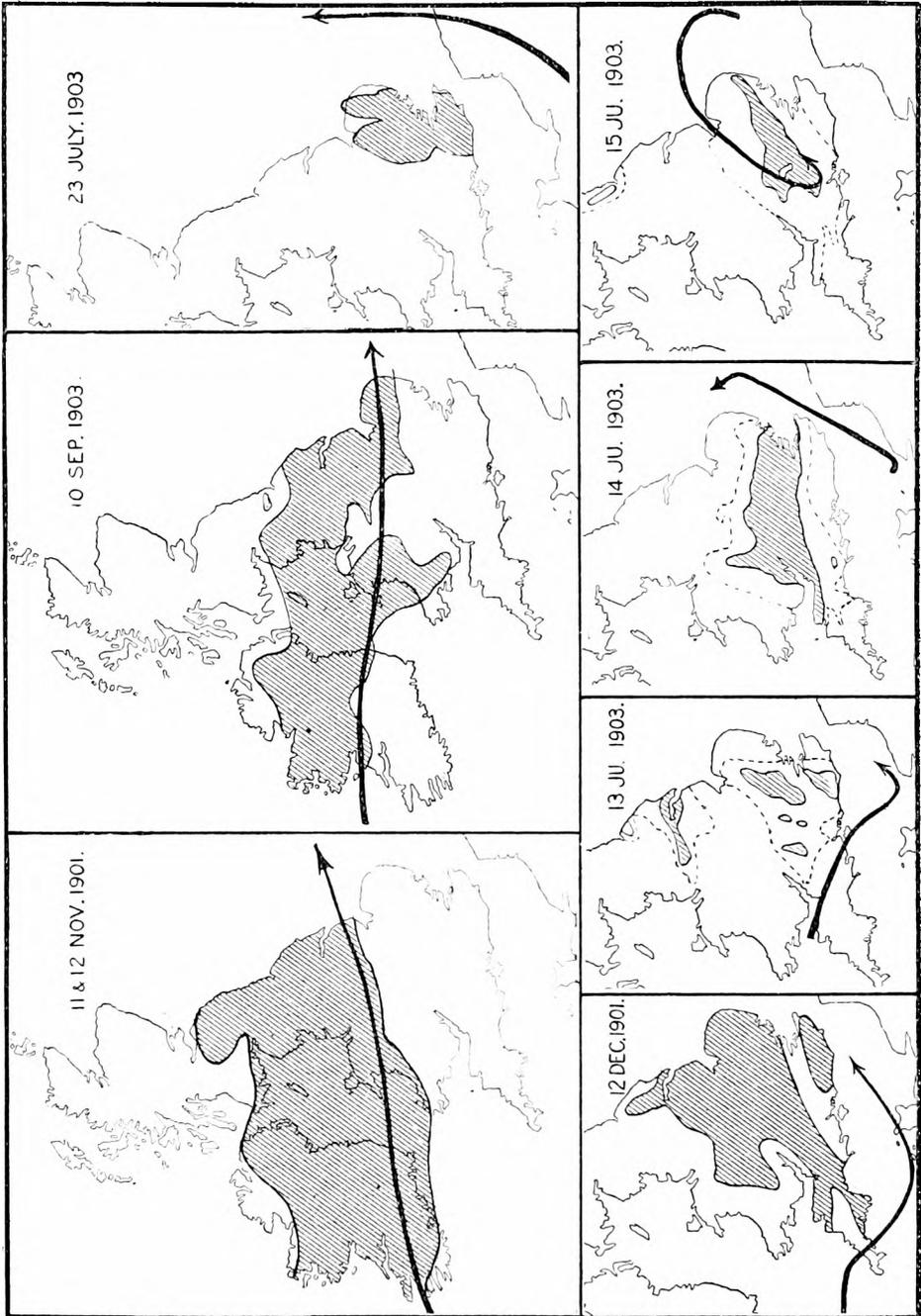
## METEOROLOGY AT THE BRITISH ASSOCIATION.

### On the Unsymmetrical Distribution of Rainfall about the Path of a Barometric Depression.

BY HUGH ROBERT MILL, D.Sc.

IN the course of studying the distribution of rainfall for publication in the annual volumes of *British Rainfall* much attention has always been paid to individual days on which heavy rain fell. These heavy rains are divisible into two categories, which for convenience may be termed Thunderstorm Rains and Cyclonic Rains. The former are typically of irregular distribution and short duration, the rainfall sometimes exceeding 3 inches in a single hour in patches separated by stretches of country where no rain falls. The latter are typically of uniform distribution over wide areas, with falls sometimes exceeding 3 inches in 24 hours, but rarely falling at a rate greater than .50 in. per hour. Cyclonic rains are characteristic of the winter months, although they may occur at any time of the year.

Ten instances of severe and widespread cyclonic rains have been investigated by the author. The method adopted was to plot upon a map the rainfall for the day in question (9 a.m. to 9 a.m.) at all stations for which the figure was available and then to draw lines limiting the areas within which the falls exceeded .50, 1.00, 2.00, 3.00, and 4.00 inches respectively. No cases were investigated in which there was not a considerable area with more than one inch of rain. The number of points from which the map was drawn varies from a few hundred to 2000 or more, according to the extent of surface affected. The maps, reduced to a small scale, have been published in *British Rainfall* during the last four years. The position of the lines may be relied upon as correct on the scale shown, the probable error lying in most cases within the thickness of the lines as drawn. For the present discussion the path of the barometric depression associated with the rain is added from the monthly summary of the *Weekly Weather Report* of the Meteorological Office.



In the ten maps prepared the path of the depression was directed towards different points of the compass. The positions of the centre are marked for the hours of observation from 8 a.m. on one day to 8 a.m. on the next, thus corresponding very closely with the rainfall day, 9 a.m. to 9 a.m. Seven of these are reproduced in the accompanying maps.

The ten cases include two in which the centre described a path nearly from S. to N.

(1) *27th October, 1903.*—Path from the Lizard along the eastern border of Wales to the Solway. The area with rainfall over one inch extended from S. to N., reaching considerably beyond the position of the centre at 9 a.m., and a larger area, though perhaps not a greater volume of rain, lay to the right of the track than on the left. This is the only instance of the kind in the ten cases.

(2) *23rd July, 1903.*—The centre travelled north-eastward from near Ushant through France and passed into the North Sea northward from Holland. The area with more than one inch of rain extended due north from the coast of Sussex and Kent to the Wash, and in the centre the falls exceeded 3 and at some points 4 inches. The whole wet area lay well to the left of the path. (See map).

In two cases the path was first directed towards the S.E. and curved round to N.E.

(3) *12th December, 1901.*—At 8 a.m. on the 12th the centre was in the Bristol Channel, at 6 p.m. in the English Channel south of the Start, and at 8 a.m. on the 13th south of Selsey Bill. The rainfall exceeded an inch from Cornwall to Kent on the south-east and to the Tees on the north-east, the whole lying well to the left of the path. (See map).

(4) *8th October, 1903.*—The centre at 8 a.m. was on the coast of Cardigan, at 6 p.m. near Oxford, and at 8 a.m. on the 9th out in the North Sea in the latitude of Flamborough Head. The rainfall exceeded an inch in the eastern half of Great Britain from the Humber to the Forth, and exceeded 3 inches on the coast of Northumberland. The whole wet area lay on the left of the path.

Two cases in which the path was nearly straight from W. to E.

(5) *11th and 12th November, 1901.*—The centre was near Valencia on the 11th, about Tipperary at 8 a.m. on the 12th, to the south of Carnarvon at 6 p.m., and in the North Sea off Grimsby at 8 a.m. on the 13th. Falls exceeding an inch prevailed over Ireland, western Wales and north-western England on the 11th, and over north-eastern Ireland, northern England, and southern Scotland on the 12th, extending on each day from 150 to more than 200 miles to the left of the path, but on neither day more than 50, and rarely more than 25, miles to the right. (See map).

(6) *10th September, 1903.*—This storm will be remembered by visitors to the British Association at Southport. The path ran Clare to Norfolk, the centre was off the Arran Islands on the 10 2 p.m., south of Carnarvon at 6 p.m., and in the middle of the N

Sea at 8 a.m. on the 11th. This centre crossed the British Isles in about 16 hours, while No. 5 required at least 30 hours; but although the centre moved more quickly, the area over which an inch or more of rain fell was not much smaller. It extended for about 130 miles to the left of the path, and, except for a narrow strip along the coast of Wales, only for from 5 to 30 miles to the right of the path. (See map). If the paths of the two depressions Nos. 5 and 6 are superimposed to allow for the slight difference in direction, the similarity of the broad, wet strip to the left and the narrow wet strip to the right is most striking.

Three consecutive days in June, 1903, showed remarkable features.

(7) *13th June, 1903.*—The path ran from the Bristol Channel to the Isle of Wight, and at 8 a.m. on the 14th was close to the French coast and turning northwards. The whole area of rainfall over half-an-inch lay to the left, and contained large tracts in the Thames basin, East Anglia and Sussex with more than an inch.

(8) *14th June, 1903.*—The centre turned north-eastward, passed through the Strait of Dover, and at 8 a.m. on the 15th it was in the North Sea off Yarmouth. A broad belt of rainfall exceeding one inch stretched across the whole of England from the Bristol Channel to the coast of Essex with patches where over two inches fell. This lay entirely to the left of the path.

(9) *15th June, 1903.*—The path suddenly curved round, and shortly after 6 p.m. the centre entered the Wash and passed south-westward across England, being near Southampton at 9 a.m. on the 16th, when it was curving eastward. This is a direction exactly opposite to that usual for cyclones crossing England; but, again, almost the entire extent of a large area with a rainfall exceeding one inch lay to the left of the path, *i.e.*, on the southern and eastern side, instead of on the northern and western side as in other cases.

During the three days in which this depression described an elliptic path round the lower Thames Valley and East Anglia, rain fell within that area continuously for about 60 hours, and amounted in that time to from 3 to 4 inches, producing a state of matters for which no precedent can be found. (See map).

One case remains.

(10) *30th December, 1900.*—The path ran from Cornwall through Portsmouth to the coast of France. The area with over an inch of rain stretched from the south coast to the Humber and Suffolk, and within it a large area had a fall exceeding 3 inches. So little of England lay south of the track that it is impossible to be quite sure, but the map certainly suggests that the greater part of the precipitation was on the left.

The conclusion drawn from the consideration of these instances is that *the belt of cyclonic rains is much wider on the left of the path than on the right, and the heaviest falls occur in advance of the centre.*

At present the fact is merely stated and the evidence collected during the last four years put forward. When more cases have been

investigated it should not be impossible to extend the conclusions, especially with regard to the parallelism or divergence of the wet belt with reference to the path, and perhaps, as a result, to improve the accuracy of regional forecasts. The interest of the question in the light of Dr. Shaw's discussion of the trajectories of the air in a cyclone is apparent. It is not known to the author with what degree of precision the position of the centre is given on the Meteorological Office charts, the paths shown were copied as accurately as possible from the official maps; but of course no allowance could be made for secondary depressions.

It is remarkable that the wide-spread cyclonic rains appear to bear no relation to the physical features of the country, however, the data are not yet sufficient to enable this question to be fully discussed.

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### Address to the Sub-Section Cosmical Physics,

BY SIR JOHN ELIOT, K.C.I.E., M.A., F.R.S.

(Continued from p. 147.)

The preceding statements have shown that variations of rainfall for prolonged periods similar in character have occurred, and may hence occur again, over the very large area including the Southern Asian peninsulas, East and South Africa, Australia, and, perhaps, the Indian Ocean. The abnormal actions or conditions giving rise to these large and prolonged variations must hence be persistent for long periods, and be effective over the whole of that extensive area, and hence cannot be inferred with certainty from the examination of the data of one small portion of the area affected—*e.g.*, India. The variations undoubtedly accompany variations in the complete atmospheric circulation over the Indo-oceanic area, and the effective forces or actions must be such as to influence the whole movement in a similar manner in the two monsoons or seasons of inverse conditions in Southern Asia. This inference furnishes a very strong reason for the conclusion that the meteorology of the whole area similarly affected from 1892 to 1902 should be studied as a whole, and not in fragmentary detail by various weather bureaus, and as at present without any co-ordination of the results of these bureaus.

The discussion has also indicated that the south-west monsoon current is a periodic or intermittent extension of the permanent circulation of the south-east trades to the peninsulas of Southern Asia, and also that variations in the strength, volume, and direction of movement of the latter affect the extension, volume, aqueous vapour contents, and precipitation of the south-west monsoon currents in Burma, India, and Abyssinia. This fact further emphasises the necessity for the co-ordination and systematisation of the work of observation in the Indo-oceanic meteorological province and the continuous and systematic examination and discussion of observations for the whole of that area.

It is, of course, possible that it may be necessary to extend this work to a larger area than the Indo-oceanic region. For Sir Norman Lockyer and Dr. Lockyer have shown that similar pressure variations to those of Bombay

occur over a large portion of the Eastern Hemisphere, and variations of opposite sign (similar to those of Cordova) over a considerable part of the Western Hemisphere.

The Indian Meteorological Department, with the sanction of the Government of India, is now arranging to collect and tabulate data for the whole area between the Central Asian winter anticyclone and the permanent South Indian Ocean anticyclone, and to utilise the information for the investigation of the causes of the large and general variations of rainfall in Burma and India from year to year. This extension of its labour is recognised as necessary for the improvement of the seasonal forecasts, an important feature of the work of the Department, the value and importance of which are fully recognised by the Government of India.

Possibly the practice of the Indian Meteorological Department in the preparation and issue of long-period or seasonal forecasts is considered to be not only unscientific, but not justified by comparison with facts. Professor Cleveland Abbe, in his paper on "The Physical Basis of Long-range Weather Forecasts," expresses his opinion that "we are warranted in saying that during the thirteen years (1888—1900) the only real failure has been that of the prediction of the monsoon season of 1899, the year of phenomenally great drought in that country." This opinion is probably more favourable than I should myself give, but it is the opinion of an independent meteorologist eminently qualified to give a judgment in the matter.

My own opinion with respect to weather forecasts is that there appears to be too strong a desire for absolute accuracy, possibly due to public and newspaper criticism. Certainty is not possible in weather forecasts based on imperfect information, and in which the introduction of a single unknown factor in regions beyond observation—*e.g.*, the upper or middle atmosphere—may completely alter the course of events. Percentages of success are an inadequate measure of the utility of forecasts. To be of real value as estimates of utility they should be calculated rather on the information required, and which might be reasonably expected, than on that actually given.

It appears to me that the striving after perfection in short-period forecasts to the exclusion of other claims is impeding the extension and progress of meteorology in other useful directions. It is absolutely essential that officials preparing or utilising forecasts should recognise that every forecast is based on imperfect information and experience, and hence that all important forecasts should be expressed as probabilities, and, whenever desirable, an estimate of the value of each probability be given.

The Government of India desires to have these seasonal forecasts, and has ordered its Meteorological Department to furnish them. The Government encourages the work, provides the additional means required by the department for its proper performance, and issues the forecasts only to those who will use them as probabilities for practical guidance.

The Government of India have sanctioned large changes in its Meteorological Department in order to enable it to carry out the extensions of work that recent experience has shown to be desirable. The Department is kept in touch with scientific opinion and judgment at home through the Observatories Committee of the Royal Society. The relations to other scientific departments in India are maintained by a special committee termed the Board of Scientific Advice. The scientific staff has been largely increased.

The solar physics observatory at Kodaikanal and the magnetic observatory at Bombay have been placed under the Meteorological Department with a view to the complete co-ordination of the departments of scientific investigation for which they are maintained. Observational data for the whole Indo-oceanic area are now being collected and tabulated with a view to the early publication of daily and monthly weather reports and charts of that area.

The area to be dealt with (*viz.*, the Indo-oceanic area) is partially covered by a number of independent meteorological systems, including those of Egypt, East, Central and South Africa, Ceylon, Mauritius, the Straits Settlements, and Australia. Large areas, as, for example Arabia, Persia, Afghanistan, Thibet, and the greater number of the islands of the Indian Ocean, are now almost completely unrepresented.

The departments controlling these systems work independently of each other, chiefly for local objects, and are in no way officially correlated or affiliated. Their methods of observation and of discussion and publication of meteorological data differ largely. It is hence difficult, if not almost impossible, to make satisfactory comparisons of the data, and trace out for the work of current meteorology the extension or field of similar variations, their relations to each other, and their probable influence on the future weather.

The work which should be carried out in order that the investigation of the meteorology of the Indo-oceanic area might be effective and as complete as possible includes the following :—

(1.) The extension of the field of observation by the establishment of observatories in unrepresented areas, and the systematic collection of marine meteorological data for the oceanic area.

(2.) The collection and tabulation of the data necessary to give an adequate view of the larger abnormal features of the meteorology of the whole area.

(3.) The direction by some authoritative body of the registration, collection, and tabulation of observations by similar methods in order to furnish strictly comparable data for discussion.

(4.) The preparation of summaries of data required as preliminary to the work of discussion, and for the information of the officers controlling the work of observation in the contributory areas. The earliest publication of the data should be regarded as essential for the use of officers issuing seasonal forecasts.

(5.) The scientific discussion of all the larger abnormal features in any considerable part of the area and their correlation to corresponding or compensatory variations in the remainder of the area, by a central office furnished with an adequate staff.

(6.) Possibly, sufficient authority on the part of the central office to initiate special observations required for the elucidation of special features for which there are no arrangements in the general work of the various systems.

The Indian Meteorological Department is making preparations to carry out a portion of this work; and will undoubtedly do the best it can single-handed with its limited means. It cannot do the work fully and as it ought to be done. It can do nothing which requires authoritative control over the remaining meteorological systems in the Indo-oceanic field. It is collecting information from those who are willing to supply it, and will utilise it for its special purposes.

It is evident the work can only be carried out fully by the co-operation of the various systems subject to limited control by a central office with acknowledged imperial or general authority behind it. The most important part of the work from the standpoint of the science of meteorology is the comparison and discussion of the whole body of observations. The constitution, position, and authority of the central office is hence of the greatest importance. It is quite certain that none of the meteorological systems directly concerned can provide such a central office. If the work is to be carried out fully and systematically it can only be arranged for in England, and by the British Government assuming the general direction and control.

At the present time a section of the British Meteorological Office is devoted to the study of oceanic meteorology for the information of mariners. Another section should be created for the study of imperial meteorology for the benefit of its dependencies and colonies. I have reason to believe that the Government of India would contribute its share towards the cost of this extension of work.

In the preceding remarks are given the chief reasons for an important extension of work now in progress in the Indian Meteorological Department, an extension which can only be carried out imperfectly by that Department, but which could be performed with most valuable scientific results by the co-ordination of the labours of the weather bureaus concerned, with a central institution or investigating office in England under Government control.

Perhaps I may be permitted, from my Indian experience, to add some general remarks bearing on the methods and progress of meteorological inquiry.

In India the collection and publication of accurate current data relating to rainfall and temperature is required for the information of Government in its various Departments. The collection and examination of pressure and wind data by a central office with a view to the issue of storm and flood warnings is equally necessary. This work may, perhaps, be described as pertaining to descriptive or economic meteorology.

Economic meteorology, so long as it deals only with actual facts of observation, is not a science. Forecasts belong to the same department or branch of meteorology. They may be based on scientific theory and be obtained by scientific methods or the utilisation of empirical knowledge. The latter method is probably sufficient for by far the greater part of short-period forecast work, but the final development of that work and the preparation of long-period forecasts require the application of exact scientific methods and knowledge. And it is, perhaps, not too much to say that the extension of the range or period of forecasts is a measure of the progress of meteorology as a science. India, by the simplicity and massiveness of its meteorological changes (and perhaps Australia and Africa), appears to be best suited for the earliest experiments in this work.

India is, however, poor, not only in material wealth and capital as compared with England, but also in the appliances and means of scientific investigation, and hence looks to England for assistance and guidance in scientific matters. Unfortunately, England lags behind, not only the United States and Germany, but even behind India, in the important field of scientific meteorological inquiry. It will suffice to give a single illustration of the anomalous and inferior position which England takes in such matters.

All meteorologists and scientific men generally are agreed that the exploration of the middle and upper atmosphere by any available means—*e.g.*, kites, balloons, &c.—is of the utmost importance at the present stage of meteorological inquiry. The United States, France, and Germany have taken up the work vigorously. The British Meteorological Office is unable, for want of funds, to share or take any part in the work. The force of scientific and public opinion is apparently powerless to move the British Government to grant an extra five hundred pounds annually for this work. The British Government, on the other hand, some time ago suggested that the Indian Meteorological Department should assist. The Government of India, recognising the importance of the work, has provided the funds and sanctioned the arrangements necessary in order that its Meteorological Department may march with the most progressive nations in this investigation.

India has no body of voluntary observers or independent scientific workers and investigators. Whatever is required to be done to extend practical and theoretical meteorology can only be effected by the Government Department to which that work is assigned, with the sanction and at the cost of the Government—which naturally considers chiefly its practical wants in relation to its limited resources. It is, from one point of view, a painful if not quite an unexpected experience to me, on my retirement, to find that the Government of India is, in its attitude towards meteorological inquiry, more advanced, more liberal and far-sighted than the British Government, and that England has not yet taken up seriously the work of scientific meteorological investigation. There are undoubtedly too many observations and too little serious discussion of observations. The time has arrived when investigation should go hand in hand with accurate observation, and should direct and suggest the work of observation, and also that the sciences directly related to meteorology should be considered concurrently with it. There are undoubtedly definite relations between certain classes of solar phenomena and phenomena of terrestrial magnetism. The probability of definite relations between solar and terrestrial meteorological phenomena is also generally admitted.

Data for the determination of these relations are being rapidly accumulated, and numerous problems connected therewith are waiting and ripe for investigation. They are too large and complex to be undertaken by present English methods, and can only be attacked by a body of trained investigators under arrangements securing the continuity of method and thought requisite for the prolonged systematic inquiry gradually leading up to their complete solution.

It would hence be desirable to enlarge the scope of the central institution I have suggested, so as to include in its field of labour the investigation of the relation between solar and terrestrial meteorology and magnetism, so far as they can be solved by the comparison of the observations of the British Empire.

The central institution would thus have large and definite fields of work and most interesting problems for investigation. It would hence contribute towards the formation of a body of scientific meteorological investigators adequate to the importance and wants of the empire, and be of the highest educational as well as scientific value.

My predecessor in this position, Dr. Shaw, the head of the British Meteorological Office, made some remarks in his Address last year which deserve repetition in connection with this idea. He said:—"The British Empire stands to gain more by scientific knowledge, and to lose more by unscientific knowledge, of the matter than any other country. It should from its position be the most important agency for promoting the advance of meteorological science, in the first place because it possesses such admirable varying fields of observation, and in the second place because with due encouragement British intellect may achieve as fruitful results in this as in other fields of investigation."

The establishment of the central institution as suggested above would provide a remedy for the defects pointed out by Dr. Shaw. The reorganisation of the British Meteorological Office is, I believe, under consideration. Is it too much to hope that a strong expression of opinion on the part of the British Association, and the influence of the learned university at which its present meeting is held, would induce the British Government to spend an additional £5000 or £10,000 annually for the promotion of meteorological investigation and the establishment of a central imperial institution in London in connection with its Meteorological Office?

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### **The Relation between Pressure, Temperature, and Air Circulation over the South Atlantic Ocean.**

By Commander CAMPBELL HEPWORTH, C.B., R.N.R.

THE South Atlantic offers an excellent field for the study of air circulation on a comprehensive scale and under normal conditions. An ocean covering an extensive area, connected north and south with great oceans and completely open to the south, it is, at the same time, free from the disturbing influences of island groups, and is bounded east and west by continents having coastlines that are for the most part exempt from large irregularities of outlines. The atmospheric circulation over the South Atlantic may therefore be recorded as one vast wind system, its air-currents undisturbed over the northern half by the occurrence of aerial eddies for the most part, and over the southern half, although at times interrupted, yet not effaced by them.

The anticyclone, or area of high barometric pressure, is the great controlling agent of the system, and round this central high pressure the winds revolve.

The circulation of the air is assisted on the eastern side of the ocean by the relatively low pressure over South Africa, on the northern side by the low pressure over the equatorial regions of the Atlantic, on the western side by the relatively low pressure over South America, and on the southern by the lower pressure of higher latitudes. The direction of the wind about the core of high pressure, stated generally, is southerly to south-easterly between it and the African coast, south-easterly and easterly towards the equator, easterly to northerly on its western side, and north-westerly to south-westerly on its southern. Over the eastern and northern segments of the system the flow of the air-current is steady; over the western and southern, particularly over the former, the circulation is less persistent. Southward of 30° S. lat., and even further to the northward, on the western

side of the South Atlantic the apparent normal circulation of the surface wind, in harmony with the course of the average isobars, is largely masked by the incursion of low-pressure systems travelling eastward or south-eastward.

On the eastern margins of the South Atlantic and South Pacific north of  $30^{\circ}$  S. lat., and in a measure also on the western margin of the former, north of the same parallel, when the conditions of the atmosphere are stable, there appears a marked inclination for the wind to follow the course of the littoral. This probably is connected with the tendency of the barometric pressure over the land to conform to the contour of the coastline.

Throughout the twelve months the shape of the isobar bounding the area of highest pressure (30.1 or 30.2) is approximately that of an ellipse. The major axis, however, does not always make the same angle with the meridian, and the axes vary, not only in position, but also in length.

Over the South Pacific throughout the twelve months there is an area of high barometric pressure, the South Pacific anticyclone, which is elliptical in shape, and is bounded by an isobar of 30.2, except during the four months March to June inclusive, when the highest value shown is 30.1.

A table given furnishes particulars of the intensity, position, and extent of the high-pressure area over the South Atlantic and eastern margin of the South Pacific, and of the mean latitude of the belt of doldrums in the North Atlantic.

The area over which the south-east trade-wind blows steadily, and the region over which westerly winds predominate, vary from month to month in harmony with the change in the position of the South Atlantic anticyclone, and with that of its intensity and extent. These variations are pointed out.

There is a general relation to be found between the direction of the prevailing wind and the average temperature of the air in the shade over the South Atlantic, on either side of the permanent area of high pressure.

Throughout the year there is a marked tendency for the air-isotherms to extend along a line drawn from the Cape of Good Hope to the Island of Ascension under the influence of the relatively cool air of the south-east trades which blow on the African side of the high pressure, and in sympathy with the cool sea-surface current setting north-westward; while, at the same time, the relatively warm north-east wind on the American side of the anticyclone, which is in sympathy with the warm sea-surface current setting south-westward, exercises a similar influence upon the air-isotherms in the vicinity of South America.

Gale frequency on the South Atlantic is indicated in a table giving the latitude and longitude of the principal points in gale-frequency curves for different seasons.

Cyclonic storms of the South Atlantic appear to reach that ocean in two ways. They cross the continent of South America somewhere between  $25^{\circ}$  S. and Cape Horn, more frequently travelling over Patagonia; or they avoid the land altogether and round Cape Horn to the eastward, following the general drift of air and sea-surface.

The percentage curves seem to show that not infrequently the cyclonic system, instead of rounding Cape Horn or crossing the land, strikes northward or north-westward up the Pacific at a distance of  $5^{\circ}$  to  $10^{\circ}$  from the west coast of South America.

### The Temperature of the Air in Cyclones and Anti-Cyclones, as shown by Kite-flights at Blue Hill Observatory, U.S.A.

By A. LAWRENCE ROTCH, B.S., M.A., Director of the Observatory.

A STUDY of the data obtained during 34 kite-flights at Blue Hill, at different seasons, and in areas of low and high barometric pressure, up to a height of about 12,000 feet, shows the mean decrease of temperature, computed by stages of 1,600 feet, to be nearly constant, averaging 1° Fahr. per 376 feet of ascent. Whether the whole column of air in a cyclone is warmer than the corresponding air in an anti-cyclone (as the convectional theory of its formation requires) depends chiefly upon whether its initial temperature at the ground is higher than that of the anti-cyclone, which is usually the case. If the data obtained from kite-flights on consecutive days be plotted for the same height (as was first done at Blue Hill in 1899), it is seen, that up to the height of 12,000 feet, it is generally warmer at all levels over areas of low barometric pressure than it is over the adjacent areas of high pressure.

Kite-flights on Blue Hill are usually made once a month upon a day fixed by the International Committee for Scientific Aeronautics. During 1903, the average of the highest points reached in the 15 flights was 7264 feet above sea-level, and the greatest height in any flight was 13,970 feet. From January to July, inclusive, this year, the nine flights have given an average elevation of 8284 feet, the highest one reaching 14,660 feet. During the present summer, it is hoped to extend the observations of temperature in the free air, by means of *ballons sondes* liberated from St. Louis, to an altitude never before obtained above the American continent.

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## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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### THE WETTEST SPOT IN THE UNITED KINGDOM.

REFERRING to Mr. Bonacina's interesting letter in last month's Magazine on the above subject, and with a view to furthering the idea to find out the wettest spot in the United Kingdom, I beg to point out what appear to be conclusive facts, showing that if the surroundings and contour of the hills, above 3000 feet, in Kerry are as favourable as The Styne and Snowdon, the precipitation at the wettest spot in Ireland ought to be higher than any place in England and Wales, for the following reasons:—

1.—As the direction of Kerry and Cumberland runs practically parallel with the general track of the Atlantic depressions, passing over the British Isles, the amount of precipitation due to the proximity to the mean path of the depressions, is as favourable at Kerry as at Cumberland and Carnarvonshire.

2.—Owing to Kerry being 300 and 200 miles more to the west and south than Cumberland, the rainfall would be likely to be more at

Kerry for the following reasons:—(a.) Higher average temperature. (b.) Surrounded by a larger expanse of the sea. (c.) More chances to obtain the precipitation, due to depressions passing northwards to the east of Kerry, and west of Cumberland, which, according to Dr. Mill's observation is heavier on the left side of the track.

3.—According to the general rule, places with a high yearly rainfall have a high number of rainy days. As the number of rainy days along the *sea coast* of Kerry is considerably more than the *sea coast* of Cumberland and Carnarvonshire, and assuming the mountain rainfall conditions are practically the same at Kerry as at The Sty, &c., the yearly precipitation on the Kerry hills ought to be more than at Cumberland, &c.

4.—The sea coast, or low level land rainfall,—viz., places *not* affected by any near hills—are probably the best guide or standard to ascertain the amount of yearly rainfall due to the geographical position and general track of the depressions, in regard to Kerry and Cumberland, &c., and the rainfall of these positions is well represented in the following places:—

|                                                                        |                                                                                  |                                                       |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------|
| Low-level and non-mountain standard<br>for Kerry represented by ... .. | } Valencia, Cahirciveen, and<br>Darrynane Abbey, yearly<br>average of—say 53 in. |                                                       |
| Low-level and non-mountain standard<br>for Cumberland—The Sty by       |                                                                                  | } Maryport, Braystones, and<br>Seascale of—say 36 in. |
| Low-level and non-mountain standard<br>for Carnarvonshire—Snowdon by |  |  | } Talarvor, Anglesey stations —say 36 in. |

It will be seen from the map that the named sea coast places of Cumberland and Carnarvonshire are not affected by any mountain condensation from the *wet points*, but not having a contour map of Valencia and Darrynane in my possession, I cannot say whether Valencia would be partly affected by any low hills, but Darrynane appears unaffected. The wettest spot at Snowdon is situated 14 miles north-east of the sea coast standard station (viz., Talarvor), with an average rainfall of 190 inches, compared with 36 inches at Talarvor, therefore the combined high rainfall features, or points of Snowdon, give 5.3 times the sea coast standard.

The Sty is also situated practically 14 miles north-east of its sea coast standard (viz., Seascale), with about 175 inches, compared with 36 inches at Seascale,—giving the combined mountain rainfall features five times the standard. So we may take it roughly that the combined high rainfall points of the wettest places in England and Wales are five times the sea level standard.

Owing to the difficulty of finding any sea level standard rainfall along the west coast of Scotland, *not* affected on the weather side by the near hills, I have left Scotland out of the calculation, but I believe it is something like those of Cumberland and Carnarvonshire, and below Kerry. Taking the Kerry sea coast standard at 50 inches, and the combined high rainfall points of Brandon Hill (3127 ft.) and Carrantuohill (3414 ft.)—both practically the same

height as Snowdon and Scafell—at only four times the standard, it is evident that Ireland could claim a wetter spot than either England or Wales. So, in conclusion, I beg to ask,—is there not an Irishman living who would undertake to ascertain the *actual* amount at the wettest spot in Kerry?

J. R. GETHIN JONES.

*Bod Gethin, Deganwy, Oct. 6th, 1904.*

### HEAVY RAIN ON AUGUST 30th, 1904.

LAST night we had a sharp thunderstorm accompanied by an exceptionally heavy downpour of rain, quite the heaviest I have ever observed either here or elsewhere. The rain began at about 7.45 p.m., accompanied by very vivid lightning, which latter, however, did not last very long. The rain continued till 11.15 p.m., when it ceased quite suddenly; the total fall in the three hours and a-half was 3.65 in. I should be glad to know if at other stations anything like this was observed.

J. ELDON ELLISON.

*Timolin Vicarage, Ballytore, Co. Kildare, August 31st, 1904.*

### THE RAINFALL OF MANCHESTER.

WE have extracted the following information from some interesting notes on the rainfall, at Withington, Manchester, covering the period 1851—1903, for which we are indebted to Mr. J. H. Casartelli, of that city. The mean annual rainfall for the 53 years was found to be 33.15 in., and ranged between 51.23 in. in the wettest year (1872) to 21.26 in. in the driest (1887). The rainfall of the five complete decades included in the series exhibits striking differences, the range between the wettest and driest of such periods amounting to 6.60 in. The figures are—

|          |          |          |          |           |
|----------|----------|----------|----------|-----------|
| 1851-60. | 1861-70. | 1871-80. | 1881-90. | 1891-1900 |
| in.      | in.      | in.      | in.      | in.       |
| 34.86    | 31.84    | 37.28    | 32.33    | 30.68     |

Although the length of the period necessary to admit of an accurate monthly distribution is open to discussion, we think that in the present case the observations have extended over a sufficient length of time to give values approaching the truth. The monthly means as calculated by Mr. Casartelli are:—

|      |      |      |      |      |       |       |      |       |      |      |      |
|------|------|------|------|------|-------|-------|------|-------|------|------|------|
| Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. |
| 2.67 | 2.07 | 2.23 | 1.79 | 2.14 | 2.90  | 3.20  | 3.46 | 3.21  | 3.65 | 2.80 | 3.05 |

The largest monthly total recorded during the period discussed was 7.15 in., in July, 1872, and the smallest .09 in. in February, 1858. The greatest fall in 24 hours ending 9 a.m. was 2.10 in. on July 13th, 1872,—a very moderate fall considering the length of the period over which the observations extend. The average number of rainy days was 183, the greatest number ever registered being 240 in 1872, and the least 131 in 1887.

## THE ST. SWITHIN'S DAY TRADITION.

AMONG the weather sayings which have long been current, and have obtained a considerable amount of credit, is that which relates to St. Swithin's Day. St. Swithin was Bishop of Winchester in the ninth century, and died on 2nd July, 862. The tradition is that at his own request, he was buried in the churchyard of Winchester. But a century later, having been canonised by the Pope, the monks considered this an unfit place for the sepulchre of a saint, and resolved to transfer his remains to the Cathedral. The day fixed upon for this translation was the 15th July, 962. But the weather proved so unfavourable on that day, and for 40 days thereafter, through violent rains, that the transference was delayed for that period of time,—thence arose the saying that if it rained on St. Swithin's day, it would continue to rain for 40 days after. The following table showing the state of the weather in regard to rainfall on the 15th July for the last eighteen years, and the number of days on which rain fell in the 40 days succeeding, with the amount thereof, may serve to test the accuracy of the saying :—

| Years. | Rainfall on<br>St. Swithin's Day,<br>15th July.<br>in. | Amount of rainfall<br>for the 40 days following<br>St. Swithin's Day.<br>in. | No. of days<br>on which<br>rain fell in<br>that period. |
|--------|--------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------|
| 1887   | ..... 00                                               | ..... 3·02                                                                   | ..... 18                                                |
| 1888   | ..... 35                                               | ..... 7·14                                                                   | ..... 28                                                |
| 1889   | ..... 26                                               | ..... 6·52                                                                   | ..... 28                                                |
| 1890   | ..... 08                                               | ..... 4·51                                                                   | ..... 16                                                |
| 1891   | ..... 11                                               | ..... 4·42                                                                   | ..... 27                                                |
| 1892   | ..... 00                                               | ..... 4·33                                                                   | ..... 18                                                |
| 1893   | ..... 00                                               | ..... 5·54                                                                   | ..... 26                                                |
| 1894   | ..... 06                                               | ..... 2·32                                                                   | ..... 25                                                |
| 1895   | ..... 00                                               | ..... 7·93                                                                   | ..... 34                                                |
| 1896   | ..... 01                                               | ..... 3·60                                                                   | ..... 17                                                |
| 1897   | ..... 00                                               | ..... 4·85                                                                   | ..... 24                                                |
| 1898   | ..... 00                                               | ..... 3·52                                                                   | ..... 16                                                |
| 1899   | ..... 00                                               | ..... 0·84                                                                   | ..... 11                                                |
| 1900   | ..... 14                                               | ..... 7·79                                                                   | ..... 28                                                |
| 1901   | ..... 51                                               | ..... 4·52                                                                   | ..... 21                                                |
| 1902   | ..... 00                                               | ..... 4·30                                                                   | ..... 16                                                |
| 1903   | ..... 70                                               | ..... 3·85                                                                   | ..... 22                                                |
| 1904   | ..... 1·40                                             | ..... 3·98                                                                   | ..... 25                                                |

From the above table it will be seen that from 1887 to 1904 there was no year in which rain fell for 40 days after the 15th. The greatest number was 34, in 1895; and in that year no rain fell on the 15th. There were three years in which rain fell on 28 days, and in all these the 15th was wet, and the total amount ranged from 6·52 in. to 7·79 in. On the other hand the next heaviest rainfall to these was 5·54 in. in 1893, with 26 days in which it fell,—and in that year the 15th was dry—and in 1897, in which the 15th was also dry there were 24 days, with 4·85 in. of rain, the next largest amount to those above specified.

WM. ANDSON.

*Dumfries, 10th September, 1904.*

RAINFALL AND TEMPERATURE, SEPTEMBER, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.      |                                   |                          |       |      | Days on which<br>0.1 or more fell. | TEMPERATURE. |      |        |       | No. of<br>Nights<br>below<br>32°. |  |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------|--------------------------|-------|------|------------------------------------|--------------|------|--------|-------|-----------------------------------|--|
|        |                                                                                                                                      | Total<br>Fall. | Diff. from<br>average,<br>1890-9. | Greatest in<br>24 hours. |       | Max. |                                    | Min.         |      |        |       |                                   |  |
|        |                                                                                                                                      |                |                                   | Depth                    | Date. | Deg. |                                    | Date.        | Deg. | Date.  | Shade | Grass                             |  |
| I.     | London (Camden Square) ...                                                                                                           | 1.17           | — .90                             | .18                      | 30    | 11   | 74.9                               | 5            | 39.1 | 26     | 0     | 2                                 |  |
| II.    | Tenterden .....                                                                                                                      | 1.28           | — 1.11                            | .30                      | 6     | 13   | 72.5                               | 5            | 38.0 | 26     | 0     | 0                                 |  |
|        | Hartley Wintney .....                                                                                                                | 1.23           | — .97                             | .32                      | 14    | 8    | 72.0                               | 5            | 33.0 | 30     | 0     | 4                                 |  |
| III.   | Hitchin .....                                                                                                                        | 1.12           | — 1.01                            | .28                      | 30    | 13   | 71.0                               | 5            | 33.0 | 19     | 0     | ...                               |  |
|        | Winslow (Addington) .....                                                                                                            | 1.41           | — .85                             | .34                      | 30    | 11   | 73.0                               | 5            | 33.0 | 30     | 0     | 4                                 |  |
| IV.    | Bury St. Edmunds (Westley) ...                                                                                                       | 1.17           | — 1.32                            | .32                      | 30    | 12   | 72.8                               | 5            | 34.5 | 30     | 0     | ...                               |  |
|        | Brundall .....                                                                                                                       | 1.78           | — .67                             | .50                      | 6     | 11   | 72.0                               | 5            | 38.0 | 26, 30 | 0     | 0                                 |  |
| V.     | Alderbury .....                                                                                                                      | 2.00           | — .39                             | .76                      | 12    | 10   | 69.0                               | 3            | 34.0 | 26     | 0     | ...                               |  |
|        | Winterborne Steepleton ...                                                                                                           | 3.13           | ...                               | 1.08                     | 30    | 12   | 69.1                               | 28           | 32.5 | 20     | 0     | 8                                 |  |
|        | Torquay (Cary Green) .....                                                                                                           | 1.81           | ...                               | .82                      | 11    | 11   | 67.7                               | 3            | 44.1 | 27     | 0     | 0                                 |  |
|        | Polapit Tamar [Launceston] ...                                                                                                       | 2.52           | — .78                             | .56                      | 13    | 13   | 67.3                               | 29           | 32.9 | 27     | 0     | 0                                 |  |
|        | Bath .....                                                                                                                           | 1.37           | ...                               | .41                      | 12    | 7    | 69.5                               | 5, 17        | 37.0 | 30     | 0     | 8                                 |  |
| VI.    | Stroud (Upfield) .....                                                                                                               | 2.27           | — .17                             | .52                      | 30    | 13   | 71.0                               | 5            | 42.0 | 20     | 0     | ...                               |  |
|        | Church Stretton (Woolstaston) ...                                                                                                    | 2.12           | — .29                             | .72                      | 12    | 12   | 66.0                               | 5, 28        | 39.0 | 27     | 0     | ...                               |  |
|        | Bromsgrove (Stoke Reformatory) ...                                                                                                   | 1.96           | + .20                             | .55                      | 12    | 9    | 68.0                               | 18           | 35.0 | 29     | 0     | ...                               |  |
| VII.   | Boston .....                                                                                                                         | 3.13           | + 1.15                            | 1.25                     | 1     | 11   | 69.0                               | 5            | 40.0 | 27     | 0     | ...                               |  |
|        | Bawtry (Hesley Hall) .....                                                                                                           | 1.16           | — .73                             | .48                      | 30    | 11   | 79.0                               | 5            | 40.0 | 22     | 0     | ...                               |  |
|        | Derby (Midland Railway) ...                                                                                                          | 1.67           | — .34                             | .54                      | 30    | 10   | 74.0                               | 5            | 38.0 | 29     | 0     | ...                               |  |
| VIII.  | Bolton (The Park) .....                                                                                                              | 1.73           | — 2.43                            | .56                      | 30    | 9    | 69.4                               | 18           | 40.4 | 11     | 0     | 0                                 |  |
| IX.    | Wetherby (Ribston Hall) ...                                                                                                          | .81            | — 1.41                            | .30                      | 2     | 11   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
|        | Arncliffe Vicarage .....                                                                                                             | 1.75           | — 3.43                            | .45                      | 30    | 13   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
|        | Hull (Pearson Park) .....                                                                                                            | 1.70           | — .53                             | .76                      | 30    | 11   | 74.0                               | 5            | 39.0 | 20, 28 | 0     | 0                                 |  |
| X.     | Newcastle (Town Moor) ...                                                                                                            | 1.18           | — 1.00                            | .33                      | 2     | 10   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
|        | Borrowdale (Seathwaite) ...                                                                                                          | 7.48           | — 5.40                            | 2.00                     | 2     | 14   | 68.7                               | 18           | 39.4 | 11     | 0     | ...                               |  |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 4.03           | + .28                             | .93                      | 14    | 16   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
|        | Haverfordwest (High St.) ...                                                                                                         | 5.10           | + 1.30                            | .89                      | 7     | 16   | 67.0                               | 17           | 34.4 | 27     | 0     | 1                                 |  |
|        | Aberystwith (Gogerddan) ...                                                                                                          | 3.96           | — .11                             | .85                      | 12    | 8    | 76.0                               | 18           | 32.0 | 25     | 1     | ...                               |  |
|        | Llandudno .....                                                                                                                      | 1.15           | — 1.72                            | .33                      | 12    | 10   | 72.0                               | 18           | 46.2 | 11     | 0     | ...                               |  |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 2.78           | — .97                             | .66                      | 30    | 10   | 69.0                               | 17a          | 35.0 | 27     | 0     | ...                               |  |
| XIII.  | Edinburgh (Royal Observy.) ...                                                                                                       | 1.55           | ...                               | .55                      | 25    | 10   | 68.4                               | 17           | 41.6 | 21     | 0     | 1                                 |  |
| XIV.   | Colmonell .....                                                                                                                      | 4.49           | + .50                             | 1.00                     | 2     | 12   | 76.0                               | 18b          | 36.0 | 26, 27 | 0     | ...                               |  |
| XV.    | Tighnabraich .....                                                                                                                   | 7.26           | ...                               | 1.31                     | 5     | 15   | 60.0                               | 1, 2c        | 38.0 | 10d    | 0     | 0                                 |  |
|        | Mull (Quinish) .....                                                                                                                 | 4.61           | — .51                             | 1.44                     | 29    | 17   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 2.23           | — .68                             | .77                      | 3     | 10   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
|        | Dundee (Eastern Necropolis) ...                                                                                                      | 2.35           | + .12                             | .90                      | 2     | 14   | 69.6                               | 7            | 38.5 | 14     | 0     | ...                               |  |
| XVII.  | Braemar .....                                                                                                                        | 2.14           | — .98                             | .71                      | 2     | 16   | 65.0                               | 19           | 29.5 | 14     | 3     | 14                                |  |
|        | Aberdeen (Cranford) .....                                                                                                            | 2.33           | — .40                             | .89                      | 2     | 15   | 65.0                               | 2            | 34.0 | 13     | 0     | ...                               |  |
|        | Cawdor (Budgate) .....                                                                                                               | 1.73           | — 1.36                            | .50                      | 2     | 13   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
| XVIII. | Glencarron Lodge .....                                                                                                               | 7.92           | — .61                             | 1.26                     | 29    | 18   | 70.0                               | 18           | 36.4 | 21     | 0     | ...                               |  |
|        | Bendamh. ....                                                                                                                        | 8.19           | — .74                             | 1.47                     | 29    | 19   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
| XIX.   | Dunrobin Castle .....                                                                                                                | 2.40           | — .19                             | .53                      | 25    | 13   | 68.0                               | 18           | 42.0 | 14     | 0     | ...                               |  |
|        | Castletown .....                                                                                                                     | 3.23           | ...                               | .77                      | 13    | 22   | 66.0                               | 6            | 32.0 | 22, 23 | 1     | ...                               |  |
| XX.    | Killarney .....                                                                                                                      | 3.42           | — 1.26                            | .81                      | 5     | 18   | 68.5                               | 16           | 41.5 | 27     | 0     | ...                               |  |
|        | Waterford (Brook Lodge) ...                                                                                                          | 4.40           | + 1.27                            | 1.00                     | 7     | 15   | 65.0                               | 17           | 35.0 | 27     | 0     | ...                               |  |
|        | Broadford (Hurdlestown) ...                                                                                                          | 2.97           | + .10                             | .54                      | 7     | 18   | 66.0                               | 18           | 38.0 | 21, 24 | 0     | ...                               |  |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 3.35           | + .62                             | 1.10                     | 12    | 14   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
|        | Dublin (Fitz William Square) ...                                                                                                     | 2.34           | + .22                             | 1.20                     | 12    | 17   | 71.6                               | 5            | 41.1 | 29     | 0     | 0                                 |  |
| XXII.  | Ballinasloe .....                                                                                                                    | 3.11           | — .03                             | .67                      | 2     | 20   | 67.3                               | 18           | 33.0 | 21     | 0     | ...                               |  |
|        | Clifden (Kylemore House) ..                                                                                                          | 5.97           | — .87                             | 1.26                     | 29    | 16   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
| XXIII. | Seaforde .....                                                                                                                       | 3.71           | + .56                             | .92                      | 2     | 11   | 68.0                               | 7            | 39.0 | 10     | 0     | 0                                 |  |
|        | Londonderry (Creggan Res.) ...                                                                                                       | 2.68           | — 1.19                            | .61                      | 2     | 17   | ...                                | ...          | ...  | ...    | ...   | ...                               |  |
|        | Omagh (Edenfel) .....                                                                                                                | 3.00           | — .71                             | .70                      | 2     | 16   | 67.0                               | 18           | 35.0 | 10     | 0     | 0                                 |  |

+ Shows that the fall was above the average; — that it was below it. a and 18, 20. b and 19. c and 6. d and 25, 26.

## SUPPLEMENTARY RAINFALL, SEPTEMBER, 1904.

| Div.  | STATION.                       | Rain.<br>inches | Div.   | STATION.                     | Rain.<br>inches |
|-------|--------------------------------|-----------------|--------|------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....    | 1·82            | XI.    | New Radnor, Ednol .....      | 2·49            |
| „     | Sheppey, Leysdown .....        | ·93             | „      | Rhayader, Nantgwilt ...      | 3·12            |
| „     | Hailsham .....                 | 1·69            | „      | Lake Vyrnwy .....            | 2·57            |
| „     | Crowborough .....              | 2·30            | „      | Ruthin, Plás Draw .....      | 1·44            |
| „     | Ryde, Beldornie Tower .....    | 1·93            | „      | Criccieth, Talarvor .....    | 2·62            |
| „     | Einsworth, Redlands .....      | 2·04            | „      | Anglesey, Lligwy .....       | 2·37            |
| „     | Alton, Ashdell .....           | 1·94            | „      | Douglas, Woodville .....     | 3·74            |
| „     | Newbury, Welford Park ...      | 1·51            | XII.   | Stoneykirk, Ardwell House    | 3·87            |
| III.  | Harrow Weald .....             | 1·50            | „      | Dalry, Old Garroch .....     | 5·17            |
| „     | Oxford, Magdalen College..     | 1·44            | „      | Langholm, Drove Road .....   | 2·92            |
| „     | Banbury, Bloxham .....         | 2·05            | „      | Moniaive, Maxwellton House   | 3·68            |
| „     | Pitsford, Sedgebrook .....     | 1·98            | „      | Lilliesleaf, Riddell .....   | ·96             |
| „     | Huntingdon, Brampton .....     | 2·07            | XIII.  | N. Esk Reservoir [Penicuick] | 2·00            |
| „     | Wisbech, Bank House .....      | 1·99            | XIV.   | Maybole, Knockdon Farm..     | 2·05            |
| IV.   | Southend .....                 | ·98             | „      | Glasgow, Queen's Park .....  | 3·12            |
| „     | Colchester, Lexden .....       | ·84             | XV.    | Inveraray, Newtown .....     | 6·25            |
| „     | Saffron Waldon, Newport..      | 1·34            | „      | Ballachulish, Ardsheal ..... | 8·82            |
| „     | Rendlesham Hall .....          | 1·52            | „      | Campbeltown, Redknowe..      | 5·33            |
| „     | Swaffham .....                 | 2·24            | „      | Islay, Eallabus .....        | 4·90            |
| „     | Blakeney .....                 | 1·86            | XVI.   | Dollar .....                 | 3·57            |
| V.    | Bishop's Cannings .....        | 2·06            | „      | Balquhiddier, Stronvar ..... | 7·60            |
| „     | Ashburton, Druid House ...     | 2·83            | „      | Coupar Angus Station .....   | 2·32            |
| „     | Okehampton, Oaklands .....     | 2·01            | „      | Blair Atholl .....           | 3·44            |
| „     | Hartland Abbey .....           | 3·37            | „      | Montrose, Sunnyside .....    | 1·79            |
| „     | Lynmouth, Rock House ...       | 2·32            | XVII.  | Alford, Lynturk Manse ...    | 2·16            |
| „     | Probus, Lamellyn .....         | 2·39            | „      | Keith, H.R.S. ....           | 2·58            |
| „     | Wellington, The Avenue ...     | 1·56            | XVIII. | Fearn, Lower Pitkerrie ..... | 2·34            |
| „     | North Cadbury Rectory ..       | 2·27            | „      | S. Uist, Askernish .....     | ...             |
| VI.   | Clifton, Pembroke Road ...     | 1·54            | „      | Invergarry .....             | 5·72            |
| „     | Moreton-in-Marsh, Longboro'    | 2·74            | „      | Aviemore, Alvie Manse .....  | 2·43            |
| „     | Ross, The Graig .....          | 2·16            | „      | Loch Ness, Drumnadrochit.    | 2·45            |
| „     | Shifnal, Hatton Grange .....   | 2·31            | XIX.   | Invershin .....              | 2·24            |
| „     | Wem Rectory .....              | 1·62            | „      | Altnaharra .....             | 2·97            |
| „     | Cheadle, The Heath House..     | 1·97            | „      | Bettyhill .....              | 2·49            |
| „     | Coventry, Kingswood .....      | 1·89            | „      | Watten, H.R.S. ....          | 2·79            |
| VII.  | Market Overton .....           | 1·91            | XX.    | Cork, Wellesley Terrace ...  | 3·88            |
| „     | Market Rasen .....             | 2·27            | „      | Darrynane Abbey .....        | 6·22            |
| „     | Worksop, Hodsock Priory..      | 1·21            | „      | Glenam [Clonmel] .....       | 4·57            |
| VIII. | Neston, Hinderton .....        | 2·09            | „      | Ballingarry, Hazelfort ..... | 2·25            |
| „     | Southport, Hesketh Park ...    | 2·24            | „      | Miltown Malbay .....         | 4·52            |
| „     | Chatburn, Middlewood .....     | 1·50            | XXI.   | Gorey, Courtown House ...    | 3·81            |
| „     | Duddon Valley, Seathwaite Vic. | 5·77            | „      | Moynalty, Westland .....     | 3·49            |
| IX.   | Langsett Moor, Up. Midhope     | 1·49            | „      | Athlone, Twyford .....       | 3·83            |
| „     | Baldersby .....                | 1·26            | „      | Mullingar, Belvedere .....   | 2·98            |
| „     | Scalby, Silverdale .....       | 1·32            | XXII.  | Woodlawn .....               | 3·09            |
| „     | Ingleby Greenhow .....         | 1·71            | „      | Westport, Murrisk Abbey..    | 4·40            |
| „     | Middleton, Mickleton .....     | ·95             | „      | Crossmolina, Enniscoe .....  | 3·81            |
| X.    | Beltingham .....               | ·63             | „      | Collooney, Markree Obsy ...  | 2·91            |
| „     | Bamburgh .....                 | ·41             | XXIII. | Enniskillen, Portora .....   | 3·12            |
| „     | Keswick, The Bank .....        | 2·23            | „      | Warrenpoint .....            | 3·65            |
| „     | Melmerby Rectory .....         | ·96             | „      | Banbridge, Milltown .....    | 3·21            |
| XI.   | Llanfrechfa Grange .....       | 2·54            | „      | Belfast, Springfield .....   | 3·89            |
| „     | Treherbert, Tyn-y-waun ...     | 5·41            | „      | Bushmills, Dundarave .....   | 2·85            |
| „     | Llandoverly, Tonn .....        | 2·99            | „      | Stewartstown .....           | 4·83            |
| „     | Castle Malgwyn .....           | 3·10            | „      | Killybegs .....              | 3·32            |
| „     | Llandefaelog-fach .....        | 1·60            | „      | Horn Head .....              | 3·80            |

## METEOROLOGICAL NOTES ON SEPTEMBER, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm. R for Rain; H for Hail; S for Snow.

## ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Fine and dry on the whole. There were a few very gloomy and unpleasant days at intervals, especially in the first half, but a great many very fine ones; the weather during the week ending on 22nd being particularly brilliant. Duration of sunshine 133·3\* hours, and of R 34·5 hours. Six sunless days. Mean temp. 56°·2, or 1°·5 below the average.

TENTERDEN.—The first half was rather unsettled, but the 4th, 5th, and 11th were splendid days. The third week was brilliant, with much E. wind. Duration of sunshine 191 hours.

CROWBOROUGH.—Cool and pleasant, with wind chiefly E. and N.E. Mean temp. 55°·0.

HARTLEY WINTNEY.—A perfect summer month, with little R and much sunshine, and absence of wind and of T. Cloudless from 18th to 23rd. Fog in mornings from 26th to 30th. Ozone on 16 days. Mean 3·6.

PITSFORD.—Beautifully fine and bright. R 62 in. below the average. Mean temp. 52°·0.

BRUNDALL.—Fine on the whole, although there were some unsettled periods, particularly during the first half. Mean temp. 1°·2 below the average. The max. exceeded 70° on one day only.

WELLINGTON.—Very fine and seasonable, with temp. equable, but rather lower than usual. R about 75 in. below the average.

NORTH CADBURY.—Showery and very humid till the 14th; very dry from 15th to 29th. High winds to 23rd, but very calm from 24th to 29th. No extreme temp.

CLIFTON.—Unsettled till 15th, when fine weather set in under the influence of an anti-cyclone, lasting, with the exception of a shower on 24th, till 29th, with cloudless skies for the first week, and afterwards, cloud. Sudden break on 30th with R and wind. R less than half the average.

WORKSOP.—A fine and pleasant month, and a grand time for fallowing work but roots would have benefitted with more R.

BOLTON.—Singularly steady bar. caused by a series of high pressure systems. These gave rise to a fair amount of easterly wind and slight R. Absolute drought from 13th to 27th. Duration of sunshine well above the average.

SOUTHPORT.—Mainly characterised by an unusual prevalence of easterly and south-easterly winds. Dry generally, the total R being 1·07 in. below the average. Mean temp. 0°·5 below the average. Duration of sunshine 22 hours above the average.

HULL.—Fine autumn weather generally, with some very bright days and mild nights. Duration of sunshine 126 hours.

LLANDOVERY.—A very pleasant month. R very small, except on 2nd and 30th, on which days half the total occurred. Sunshine plentiful.

HAVREPOURWEST.—Fine and warm. R above the average, mostly falling at night. Very fine from 17th to 24th, with no R but strong winds. Duration of sunshine 140·3 hours. Crops everywhere were excellent and harvested in good condition.

DOUGLAS.—Very fine despite 3·74 in. of R, which all fell on nine days. From 17th to 28th was rainless and brilliantly fine, with drying winds, and the harvest was well saved. Strong N.W. gale on 9th, and a violent inshore (E.S.E.) gale on 12th, causing unusual dislocation of cross-channel traffic, and great difficulty in landing passengers here.

## SCOTLAND.

CARGEN [DUMFRIES].—Notwithstanding the wet weather at the beginning a better harvest had not been experienced for many years. Potatoes and turnips, however, suffered.

\* Campbell-Stokes.

**MAXWELTON HOUSE.**—The last three weeks were very fine, bright and dry and excellent for the harvest.

**LILLIESLEAF.**—R 1·11 in. below the average. The latter half of the month was quite lovely, but the leaves were beginning to turn at the end. Crops were good and heavy and well got in, and there was no R to do any damage.

**COLMONELL.**—The first 9 days and the last 2 were wet, but the remainder was ideal weather for harvest, though there were slight falls on a few days and moderate to high winds.

**TIGNABRUAICH.**—On 18th a slight earthquake shock was felt, preceded by a loud report at 4.10 a.m. No damage was done.

**MULL, QUINISH.**—Very warm and dry with E. wind from 10th to 25th. The harvest was unusually good.

**CASTLETOWN.**—Good harvesting weather throughout, most of the R falling during the night. Warm, damp winds from 18th to 24th.

### IRELAND.

**DARRYNANE ABBEY.**—The first part was wet, followed by some very fine days from 18th to 26th. R 14 per cent. above the average.

**MILTOWN MALBAY.**—The first half was wet, the second dry and sunny and splendid for harvest.

**DUBLIN.**—A favourable month. R fell frequently up to 15th, very heavily on 12th but an anticyclone of much staying power and some intensity caused beautifully fine and bright weather from 16th to 25th. Mean temp. 56°·8. Duration of sunshine 161 hours.

**MARKREE OBSERVATORY.**—The first part was showery with no very heavy falls. Mild weather set in about 12th, and from that date very little R fell.

**OMAGH.**—The weather until the 16th was so persistently wet and unfavourable that fears for the harvest had become acute, when on the 17th a brilliant period of 12 days followed, and was taken advantage of so well that a harvest in this country has seldom been garnered in better order.

## THE NINE MONTHS' RAINFALL OF 1904.

*Aggregate Rainfall for January—September, 1904.*

| Stations.             | Total Rain. | Per cent. of Aver. | Stations.           | Total Rain. | Per cent. of Aver. | Stations.         | Total Rain. | Per cent. of Aver. |
|-----------------------|-------------|--------------------|---------------------|-------------|--------------------|-------------------|-------------|--------------------|
|                       | in.         |                    |                     | in.         |                    |                   | in.         |                    |
| London .....          | 15·61       | 97                 | Arnccliffe .....    | 41·77       | 98                 | Braemar .....     | 20·45       | 86                 |
| Tenterden .....       | 17·64       | 95                 | Hull .....          | 17·81       | 101                | Aberdeen .....    | 20·89       | 95                 |
| Hartley Wintney ..... | 18·34       | 105                | Newcastle .....     | 17·54       | 96                 | Cawdor .....      | 17·42       | 79                 |
| Hitchin .....         | 17·04       | 104                | Seathwaite .....    | 93·24       | 102                | Glencarron .....  | 62·63       | 97                 |
| Winslow .....         | 18·02       | 108                | Cardiff .....       | 33·70       | 125                | Dunrobin .....    | 21·09       | 100                |
| Westley .....         | 16·25       | 90                 | Haverfordwest ..... | 32·06       | 112                | Killarney .....   | 38·92       | 103                |
| Brundall .....        | 15·75       | 88                 | Gogerddan .....     | 33·65       | 114                | Waterford .....   | 33·47       | 123                |
| Alderbury .....       | 21·95       | 118                | Llandudno .....     | 19·84       | 98                 | Broadford .....   | 29·72       | 125                |
| Ashburton .....       | 40·13       | 125                | Dunfries .....      | 30·06       | 100                | Carlow .....      | 26·78       | 113                |
| Polapit Tamar .....   | 32·76       | 133                | Lilliesleaf .....   | 22·75       | 107                | Dublin .....      | 19·16       | 99                 |
| Stroud .....          | 22·54       | 118                | Colmonell .....     | 31·61       | 105                | Mullingar .....   | 27·18       | 103                |
| Woolstaston .....     | 22·23       | 110                | Glasgow .....       | 27·37       | 108                | Ballinasloe ..... | 30·32       | 117                |
| Boston .....          | 16·89       | 116                | Inveraray .....     | 51·62       | 105                | Clifden .....     | 62·49       | 112                |
| Hesley Hall .....     | 17·06       | 115                | Islay .....         | 36·95       | 119                | Crossmolina ..... | 46·37       | 131                |
| Derby .....           | 16·72       | 102                | Mull .....          | 43·72       | 114                | Seaforde .....    | 28·30       | 111                |
| Bolton .....          | 24·83       | 84                 | Loch Leven .....    | 26·95       | 108                | Londonderry ..... | 31·15       | 106                |
| Wetherby .....        | 21·07       | 124                | Dundee .....        | 21·60       | 113                | Omagh .....       | 33·12       | 118                |

Climatological Table for the British Empire, April, 1904.

| STATIONS.<br><br><i>(Those in italics are South of the Equator.)</i> | Absolute. |       |          |                 | Average. |      |            |           | Absolute.    |                | Total Rain. |       | Aver. Cloud. |
|----------------------------------------------------------------------|-----------|-------|----------|-----------------|----------|------|------------|-----------|--------------|----------------|-------------|-------|--------------|
|                                                                      | Maximum.  |       | Minimum. |                 | Max.     | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth.      | Days. |              |
|                                                                      | Temp.     | Date. | Temp.    | Date.           |          |      |            |           |              |                |             |       |              |
| London, Camden Square                                                | 67·9      | 14    | 35·8     | 22              | 59·0     | 42·4 | 42·4       | 77        | 112·3        | 27·4           | 1·02        | 10    | 5·6          |
| Malta                                                                | 74·6      | 12    | 45·2     | 1               | 68·9     | 55·6 | 53·1       | 77        | 124·5        | 43·7           | ·17         | 3     | 3·2          |
| Lagos, W. Africa                                                     | 90·0      | 25    | 70·0     | 20 <sup>a</sup> | 87·7     | 76·4 | 74·5       | 73        | 145·0        | 67·0           | 3·99        | 11    | 4·8          |
| Cape Town                                                            | 82·7      | 5     | 47·3     | 21              | 68·4     | 54·2 | 54·9       | 81        | ...          | ...            | 5·93        | 16    | 5·8          |
| Durban, Natal                                                        | 94·5      | 26    | 53·7     | 27              | 82·5     | 62·6 | ...        | ...       | 146·8        | ...            | ·65         | 5     | 2·7          |
| Mauritius                                                            | 84·4      | 5     | 62·3     | 13              | 80·4     | 68·4 | 67·2       | 79        | 149·1        | 55·2           | 4·00        | 21    | 6·4          |
| Calcutta                                                             | 101·5     | 23    | 69·4     | 10              | 95·2     | 77·4 | 74·6       | 72        | 157·3        | 67·0           | ·33         | 1     | 1·2          |
| Bombay                                                               | 91·1      | 28    | 75·2     | 18              | 89·0     | 77·9 | 73·5       | 74        | 140·6        | 68·8           | ·00         | 0     | 1·5          |
| Madras                                                               | 100·4     | 23    | 74·2     | 4               | 94·4     | 77·8 | 75·1       | 77        | 145·6        | 71·2           | ·00         | 0     | 2·1          |
| Kodaikanal                                                           | 77·3      | 6     | 48·8     | 15              | 70·4     | 54·0 | 49·7       | 64        | 140·8        | 37·3           | 4·21        | 11    | 4·0          |
| Colombo, Ceylon                                                      | 91·0      | 6, 7  | 73·6     | 19              | 88·9     | 77·8 | 74·3       | 78        | 153·4        | 68·6           | 5·40        | 13    | 5·5          |
| Hongkong                                                             | 83·8      | 26    | 59·7     | 1               | 75·2     | 67·8 | 66·6       | 86        | 139·0        | ...            | 1·91        | 12    | 8·3          |
| Melbourne                                                            | 86·9      | 14    | 41·8     | 18              | 71·3     | 50·9 | 51·9       | 73        | 140·1        | 34·2           | ·77         | 3     | 4·2          |
| Adelaide                                                             | 93·9      | 6     | 47·9     | 23              | 78·8     | 58·4 | 50·4       | 54        | 145·0        | 43·1           | 2·01        | 6     | 3·1          |
| Coolgardie                                                           | 97·5      | 5     | 42·9     | 18              | 79·8     | 55·7 | 48·3       | 49        | 160·3        | 36·8           | ·48         | 1     | 3·0          |
| Sydney                                                               | 77·0      | 3     | 53·3     | 21              | 69·6     | 59·2 | 57·9       | 86        | 116·3        | 41·9           | 12·60       | 28    | 6·2          |
| Wellington                                                           | 70·5      | 17    | 42·5     | 26              | 62·8     | 50·4 | 39·7       | 53        | 124·0        | 35·0           | 2·78        | 10    | 7·0          |
| Auckland                                                             | 71·5      | 4     | 48·0     | 28              | 65·7     | 54·9 | 52·1       | 74        | 134·0        | 40·0           | 5·33        | 12    | 5·0          |
| Jamaica, Negril Point.                                               | 89·3      | 12    | 66·9     | 1               | 85·1     | 70·1 | 69·5       | 73        | ...          | ...            | 5·82        | 9     | ...          |
| Trinidad                                                             | 90·0      | 17    | 65·0     | sev.            | 83·9     | 67·6 | 73·0       | 84        | 159·0        | 60·0           | 2·50        | 9     | ...          |
| Grenada                                                              | 87·0      | 26    | 69·8     | 10 <sup>b</sup> | 82·7     | 73·6 | 68·6       | 73        | 146·2        | ...            | 3·35        | 17    | 3·9          |
| Toronto                                                              | 58·3      | 9     | 19·2     | 20              | 47·0     | 31·4 | 32·1       | 76        | 122·7        | 11·0           | 3·11        | 14    | 6·5          |
| Fredericton                                                          | 64·7      | 24    | 6·7      | 4               | 50·9     | 27·6 | 23·7       | 50        | ...          | ...            | 4·19        | 11    | 5·9          |
| Winnipeg                                                             | ...       | ...   | ...      | ...             | ...      | ...  | ...        | ...       | ...          | ...            | ...         | ...   | ...          |
| Victoria, B.C.                                                       | 73·6      | 12    | 35·2     | 7               | 57·4     | 44·0 | ...        | ...       | ...          | ...            | ·73         | 7     | 6·1          |
| Dawson                                                               | 57·5      | 24    | 0·0      | 3               | 45·5     | 23·1 | ...        | ...       | ...          | ...            | ·57         | 7     | 5·3          |

a and 28. b and 11

MALTA.—Mean temp. of air 60°·7 or 1°·1 above the average. Mean hourly velocity of wind 0·1 miles below average. Mean temp. of sea 63°·0.

Natal.—R 2·24 in. below 30 years average. Hot winds on 25th and 26th.

Mauritius.—Mean temp. of air 1°·2, dew point 1°·6, and R 1·20 in. below, averages. Mean hourly velocity of wind 8·8 miles, or 1·7 below average.

KODAIKANAL.—Mean temp. of air 60°·2. Bright sunshine 222 hours, daily wind velocity 287 miles.

COLOMBO.—Mean temp. of air 83°·1, or 0°·6 above, dew point 0°·3 below, and R 5·79 in. below, averages. Mean hourly velocity of wind 8 miles.

HONGKONG.—Mean temp. of air 70°·7. Bright sunshine 112·4 hours. Mean hourly velocity of wind 14·8 miles.

Adelaide.—Mean temp. of air 4°·6 above normal, and only once exceeded in 48 years. R ·18 in. above average.

Sydney.—Mean temp. of air 1°·6 below, humidity 7·7 above, and R 6·97 in. above, averages.

Wellington.—Mean temp. of air 4°·6 above, and R 1·73 in. below, averages.

TRINIDAD.—R ·38 in. above 40 years average.

# Symons's Meteorological Magazine.

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## THE VENGEANCE OF THE RAIN GODS.

BY THE EDITOR.

AMONG the latest of the ever-fresh and interesting notes "From an Oxford Note Book," in *The Observatory*, we find a racy sketch of a railway journey in the south-west of the United States, describing how a train dodged the "wash-outs" of August last, on its way to and from the Grand Canyon of Arizona. The travelling astronomer does not venture to assign any occult reason for the cause of his troubles, though a superstitious soul might easily see that the stars in their courses fought against him.

We happened to follow the same route a month later, also paying a visit to the Grand Canyon, a natural feature vaster and more impressive than Niagara itself, and less easy to describe, for Niagara differs only in magnitude from humbler cataracts known to everyone, but the Grand Canyon is altogether unique, and comparison with nothing familiar can help one to realize it. We, too, met with "wash-outs," but putting ourselves in the position of the original dwellers on those arid plains we met also with extremely instructive reasons for their occurrence; reasons which suggest some reflections.

Escaping from the chaos of St. Louis and the noise and heat of the World's Fair in a special train of Pullman cars, a party of about sixty members of the Eighth International Geographical Congress crossed the Mississippi and sped over the rich farming lands of Kansas for a night and a day. That State, larger than England and (this year) as green and fertile, grows gradually drier towards the west, where the diminishing rainfall begins to be supplemented by irrigation. When it is followed by Colorado, New Mexico and Arizona, the aridity increases, until the land no longer bears crops, no longer supports live stock, and finally becomes a nearly waterless desert, the brown surface only starred by patches of cactus-like vegetation with here and there a grove of small pines, which seem to find sufficient moisture in the dew. When we passed, there had been no rain for a month or more, and insufficient rain for several years. The mean annual fall is well under ten inches, and on the edge of the

Grand Canyon the hotels depend for their water supply on tank waggons hauled by rail for 130 miles; the stream on the plateau half-way down to the bottom of the canyon, though only half-a-mile distant horizontally, being less accessible on account of the rough ascent of 3000 feet up which water would have to be carried. As we crossed the great plateau of Arizona, which swells up in monotonous level plains to the height of 7000 feet above the sea, effacing the Rocky Mountains, we met everywhere the same complaints of lack of water, reduction of live-stock and poor harvests.

The arid region has a very thin white population, and beyond the immediate neighbourhood of the railway there is practically none at all. Occasional villages of the Pueblo Indians, built of *adobe*, or unbaked brick, and groups of Navajo and wandering Moki Indians, indicate a considerable survival of the aboriginal peoples, and a little acquaintance with them soon showed us, beneath the veneer of Spanish civilization, the pagan spirit of the past. It is a mistake to suppose that the belief of such primitive peoples in occult powers is entirely unreasonable, for they can usually point to experience of a sort in justification of their faith. It is a mistake also to suppose that the appeal to experience in a pagan spirit is dead in modern civilization, for it is not. We shall first tell our story and then point its moral.

On the hot and cloudless afternoon of September 25th our train stopped on the open plain between Lamy and Albuquerque, in the territory of New Mexico, about a quarter of a mile from a certain Pueblo village, and as we left the cars a few blasts of the whistle brought the children hurrying out towards us like bees from a hive. Each had something to sell: fruit or coarse earthenware, bows and arrows, beads or fragments of ore supposed to be malachite and turquoise. The older people were less demonstrative and for the most part they kept aloof, standing statuesquely on the flat roofs of their huts, or just inside their doors. A little adobe church stood outside the village, but though it was Sunday no one paid it any attention, for this was not the day to expect the visiting priest. In the centre of the village a peculiar circular building, some sort of pre-Christian temple, was the centre of interest. The Indians stood about it in groups and resented any of our party approaching or photographing it.

After some time a villager, who spoke a little English, appeared and asked us to go away as we had intruded upon them at a very inconvenient time; they were about to commence a great rain-dance, which would last for three days and on which no scoffing strangers ought to look. A long palaver ensued, dollars were talked of, and finally a compromise was arrived at. We were to be allowed to see the beginning of the dance, but on no account to photograph it, since it was very sacred, and nothing could be allowed that might interfere with its prompt efficacy, for rain was much needed. The compact was made and the dance began. The

scene was curious and full of interest ; most of the men who took part in the dance were striking-looking athletic fellows, their fine russet complexions touched up by red and white paint, their clothes of the brightest colours, and each carrying some symbolic object, such as a stalk of Indian corn or a branch with fruit. One after another they paced and pranced in a wide circle with various mystic movements ; all were in dead earnest : they wanted rain badly and meant to get it ; and so we left them, after watching until the calls of the engine whistle became too insistent to be disregarded.

Next morning we came to the edge of the Grand Canyon ; the dead greyish-green plain broke away in an indescribable series of precipices, buttressed walls and smooth slopes, white, yellow, red, brown and deep purple, as the whole series of geological strata, from Carboniferous to Archæan, lay exposed in the sides of the gorge, a mile deep and ten miles across. We saw only a narrow slice of the wonderful canyon, the full length of which is 250 miles, but we saw enough to fill our minds for the two days' stay and to appreciate the unclouded serenity of the sky, which allowed the high sun to show up every detail of the view.

The sky remained unclouded until sunset on September 28th, when the train on its return journey stopped a few miles to the west of Albuquerque for a visit to another Indian village, this time one of the industrial Navajo tribe. Amongst the possessions of the village there was a pair of rough images of rain gods, male and female, with which the Indians would not willingly have parted. One of the American men of science who were in the party brought back these rain gods to the train as a trophy for the anthropological collection of one of the museums in the east. No doubt this was a gain to science, and it may perhaps enable us to give a photograph and detailed description of the successors of Jupiter Pluvius in a later number of this Magazine ; but we fear that such considerations would not console the Navajos for their violated altar, and to the untutored mind the acquisition must have appeared not merely an unwarrantable action but an outrage crying aloud for vengeance.

The train reached Albuquerque at 11 p.m., and there we left it to return to Europe and the cares of British Rainfall, while the majority of the party, with the images of the gods packed irreverently in a "grip," proceeded southward toward Mexico. As they steamed out with laughing farewells a gentle drizzle of rain called attention to the fact that the sky had clouded over, but to this we paid little heed and repaired with a feeling of no small satisfaction to a luxurious bed-room in the beautiful Hotel Alvarado after five nights spent in the cramped quarters of a Pullman car. Before we slept rain was dashing against the windows and pouring in noisy torrents off the broad eaves of the roof.

On the morning of the 29th of September rain was still falling heavily and old inhabitants dropped in to speak of the twenty years they remembered without anything approaching such a torrent

as was then roaring from the water-pipes of the roof and making the shelter of the broad cloisters round the hotel welcome for another reason than its shade. We breakfasted leisurely because the train we waited for was late, and gloomily because the sleeping cars were all full and we should have to travel in the day car and sleep at Trinidad, Colorado, losing a day and running some risk of missing the steamer at New York. However, when the train came up room was found in the Pullman and we proceeded on our way accompanied by rain as persistent as ever graced Seathwaite or the West Highlands. Rivers which four days earlier had looked like wide and badly-metalled roads were now rushing brown torrents overflowing their banks. The train ventured cautiously along the embankments which the streams were rapidly washing away. At every bridge a group of anxious men stood watching the rising water and we awaited their signal before commencing to creep across. At one point, in passing through a cutting at the base of a sudden volcanic hill, a piece of stone loosened by the wet bounded down the slope and through the last window of the train, dashing the thick plate glass into fragments. A second later it would have gone clear, a second earlier it would have burst like a shell into one of the sleeping berths. We reached Trinidad at midnight, with many stops and jerks, and the cry from an awakened sleeper, "Off the rails at last; I guess we're hung up for three days"; but we jolted on, and at noon next day, when passing in fine weather through fertile Kansas, we learned from the newspapers that three hours after we had left it Trinidad had fallen a victim to the flood. Five hundred feet of the railway had been washed away, the gas and electric works flooded and all lights extinguished, the railway station wrecked, and immense damage done in the town. The train behind had to wait two days, but we reached New York up to time.

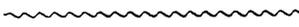
Weeks afterwards we heard of the special train which we left bearing the unwilling rain gods towards Mexico. It had not proceeded far on its way to the frontier when a "wash-out" on the line and a broken bridge ahead compelled it to stop, and an attempt was made to return to Albuquerque only to find that another "wash-out" had occurred later, imprisoning it for three dreary and hungry days. There was no dining car on the train, but forty dozen eggs were commandeered from the freight car of a train behind which was caught in the same misfortune. A solitary hut supplied the typical Mexican cakes known as tortillas, to the great profit of the lady in charge but little to the satisfaction of the party. A steak was procured somehow and cooked on the coal shovel over the engine fire, and those passengers were happy who secured a square inch of the tempting delicacy.

So much for the story; the moral is shorter. The Pueblo Indians, when next their priest tries to reason with them in the little church on the futility of their superstitious dances, will think complacently of the unmistakable efficacy of the rain dance of September 25th,

which had produced the memorable rains of the 28th and 29th, and all other arguments will be of no avail. The Navajos, if ever they hear of the fate of the excursion train, will have no hesitation in tracing the rain gods' vengeance for the desecration of their shrine, and they will set up new images with increased confidence in their power to control the elements. They will argue, not without reason, but the reason they give is not scientific and purely fallacious. The Indians will not remember instances of rain dances held in vain. of rain gods stolen or destroyed without a break in the serenity of the sky, nor will they consider the hard fate of the train with the eggs, which was carrying a crowd of innocent visitors returning from St. Louis to their homes without the luxury of sleeping cars.

The Navajo, who attributes the rain to divine vengeance, will never listen patiently to the Pueblo who knows that it was a reward for a particularly meritorious ceremony; nor will the Pueblo tolerate the belief of the Navajo any more than the moon-weather-man, who proves that the waxing moon brings rainy weather and the waning moon brings dry weather, will admit the accuracy of his brother-crank, who demonstrates the drought of the waxing and the drench of the waning phases of that unconscious orb.

We can afford to smile at the Navajos and the Pueblos, and at other illiterate persons, who look on the weather and on life with unscientific eyes. But we must not smile upon any attempts to claim scientific value for unrelated coincidences, however well meaning they may be, or however conscientiously the persons putting them forward may believe in their unproved hypotheses. It is true that the detection of coincidences not infrequently leads to the discovery of a law connecting phenomena, but to the scientific mind the exceptions must be explained before the rule can be proved, and a theory which may be true cannot be assumed or announced as true until it has been rigidly tested. We have convinced ourselves that the Navajo and Pueblo type of mind, in civilized man at least, is incapable of realizing its own limitations, and will persist in its own modes of thought, despite all arguments, and we shall try no more to influence it: but we feel it a duty to urge our readers to beware of forming conclusions, even in meteorology, without full information.



## Correspondence.

To the Editor of *Symons's Meteorological Magazine*.

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**THE ST. SWITHIN'S DAY TRADITION.**

I THINK that one may take it for granted that in all popular traditions and superstitions there is a substratum of truth. It is "unlucky" to pass under a ladder, because there may be a man painting atop. It is "unlucky" in driving to divide a flock of sheep, for just as you are passing, those on one side may run under your wheels to rejoin those on the other side. It is "unlucky" to spill the salt at table, because this shows that your hand is not in the state of steadiness which indicates normal health.

Now the legend of St. Swithin is that if it rains on July 15th it will rain for the 40 days following, and *vice versâ*; i.e., that at that particular period of the year the weather is likely to remain fixed, in one direction or another. It occurred to me some years ago to verify this by dividing the whole year into periods of 40 days, and seeing whether there was a less difference between the daily maximum and minimum rainfall during the period succeeding July 15th than during any other such period. By the courtesy of the Secretary of the Royal Meteorological Society I obtained access to the returns for the previous 20 years, which I carefully tabulated. I have, unfortunately, mislaid my MS., and cannot now put my hand upon it. But I remember that the outcome of my enquiry was that there were two 40-day periods when the weather appeared to be much more constant than in any other such period, and that of these two the St. Swithin period stood clearly first.

W. C. PLENDERLEATH.

*Mamhead Rectory, Devon,*

We take the liberty of quoting the following interesting letter from *The Observatory* :—

A letter from a Dumfries correspondent in the October number of *Symons's Meteorological Magazine* has suggested an inquiry as to the verdict of the Greenwich records on this subject. I have examined the figures for 64 years (1841 to 1904), counting only the days when 0·005 inch was registered, and it certainly seems that the tradition does not find very strong support.

In some few years (*e.g.*, 1856—1863, when the rain gauges were only examined at 9 p.m.) there is a little doubt as to the day on which rain actually fell, but it is of no great consequence.

In no year were there more than thirty-one or less than four wet days in the forty succeeding July 15, so that the probability of absolute accuracy of the tradition vanishes at once.

In twenty of the years at least half of the forty days were wet, but in only five of these years was St. Swithin's Day wet, and it was dry in the two years showing most wet days in the forty. On the other hand, although in the two driest seasons, with only four and six wet days respectively, in

the period under consideration, St. Swithin's Day was dry, yet in 1887, after a wet July 15, only nine of the forty days were wet.

From another point of view, the heaviest rainfall during the forty days, which was 9·73 inches in 1903, followed a dry St. Swithin's; and of the sixteen years in which that period produced over 4 inches of rain, only two had a wet St. Swithin's.

It would seem, therefore, that the legend does not apply to Dumfries or Greenwich. Perhaps Winchester records might tell a different tale, but it is not likely, even if they allowed for the change of style, which would alter the date by a week.

It is noticeable that there has been no rain at Greenwich on July 15 since 1896, and in the whole period there are 41 dry festivals as against 23 wet ones.

On an average, a wet St. Swithin's entails 17 wet days out of the next 40, with an average total rainfall of 3·13 inches, and a dry one brings the same number of wet days with an average total rainfall of 3·33 inches.

W. W. B.

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### BALL LIGHTNING.

I HAVE been informed of the two following different cases of ball lightning:—Some years ago, probably in 1887, the station master at Cranleigh was walking along the platform during a heavy thunderstorm with rain; just as he was about to pass under the roofing a fire ball fell on the platform at his feet, bursting with a great flame, but doing no damage. It occurred just in front of the window of his own house, and his wife, who was looking out of the window at the time, saw the fire ball fall and explode, and was greatly alarmed until she saw her husband was safe. The ball was described as being larger than a cricket ball.

In 1891 a fire ball fell in Amptill-road, Bedford, during a thunderstorm. Captain Tottenham, who saw it fall, told me that the ball came down like a red hot shot, and made a hole into which he thrust his stick the next morning.

J. P. MACLEAR.

*Chiddingfold, 17th October, 1904.*

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### THE DRY AUTUMN OF 1904.

I HEREWITH submit the following remarkable figures of rainfall, September and October, 1903 and 1904:—

|       |           |     |     | Depth.  |     |     | Number of   |
|-------|-----------|-----|-----|---------|-----|-----|-------------|
|       |           |     |     | Inches. |     |     | rainy days. |
| 1904. | September | ... | ... | 0·60    | ... | ... | 5           |
| „     | October   | ... | ... | 0·74    | ... | ... | 8           |

1·34 inches in 2 months.

Total rain from 23rd August—that is 68 days = only 1·41.

Compare this with last year :—

|       |           |     |     | Depth.<br>Inches. |     |     | Number of<br>rainy days. |
|-------|-----------|-----|-----|-------------------|-----|-----|--------------------------|
| 1903. | September | ... | ... | 2·62              | ... | ... | 17                       |
| „     | October   | ... | ... | 8·07              | ... | ... | 26                       |

10·69 inches in 2 months.

A few miles away in September there fell one or two showers which did not touch me here.

Surely taking September and October together the smallness is a record.

W. F. VINT.

*The Cedars, Sunderland, October 31st, 1904.*

It will interest you to know that last month's record of the rainfall at Lockwood Reservoir—on the moorland between Whitby and Guisborough—shows that rain fell on 10 days, but the total fall is only 0·57 in.

This is the lightest rainfall for any month of October since our gauge was fixed in the spring of 1872.

WILLIAM PANSON.

*Saltburn-by-the Sea, 4th November, 1904.*

The following may be reprinted in connection with the above :—

#### A CONTRAST IN LONDON RAINFALL.

*To the Editor of The Times.*

SIR,—This day last year I addressed to you a letter recording the fact that the rainfall at this station since January 1 had reached the total of 34·61 in., thus exceeding the total fall of any whole year since the record began in 1858. It may interest some of your readers to know that the rainfall here for the present year since January 1 amounts only to 17·09 in., rather less than half of the fall in the corresponding period of the unprecedentedly wet year 1903. The contrast is striking and cannot fail to attract the attention of all those whose interest in the weather prompts them to keep a rain gauge.

The mean rainfall for the first ten months of the 45 years 1858—1902 is 20·59 in. at this station, thus 1904 has so far had 83 per cent. of the average, while last year to the same date had 168 per cent. Eleven years in the last 46 have been drier for the same period than 1904 has proved, the extreme case for the ten months having been 1898 with 13·21 in., while 1864 and 1887 had also less than 15 in. for the same period,

Unless November and December prove quite exceptionally wet, this year will once more confirm the apparently meaningless “rule” that all years ending in four are dry ; since 1814 there has only been the one exception of 1894.

Your obedient servant,

HUGH ROBERT MILL.

*62, Camden Square, London, N. W., Oct. 28.*

**STRUCTURAL DAMAGE BY LIGHTNING.**

WE are indebted to Mr. F. Rayner, C.E., of Nottingham, for calling attention to the interesting case of damage by lightning, illustrated in the accompanying photograph, for permission to reproduce which we have to thank Mr. Morris, of Bingham.

During a severe thunderstorm on March 29th, 1904, the house shown in the photograph was struck by lightning and wrecked. From the picture it appears that the discharge took place along the chimney, which was split open down to the ground, while almost the whole wall of the upper room was thrown down and the roof above it collapsed. No one was killed, though one person was slightly injured. The house stood in the village of Whatton, in the Vale of Belvoir, about half-a-mile from Aslockton Station on the Great Northern Railway.



*Photograph by Mr. Morris, Bingham, Notts.]*

EFFECT OF LIGHTNING AT WHATTON.

## METEOROLOGICAL NEWS AND NOTES.

HIS MAJESTY THE KING has intimated that it will afford him much pleasure to become an annual subscriber to the funds of the British Rainfall Organization, in the work of which he has already been graciously pleased to participate by supplying records of the fall of rain from Buckingham Palace, Windsor, Sandringham and Balmoral. The conspicuous honour done to this voluntary organization by the King must be profoundly gratifying to all observers.

THE PRINCE OF WALES has honoured the Royal Meteorological Society by accepting the position of Honorary President. This new office, inaugurated under such distinguished auspices, cannot fail to increase the dignity and usefulness of the Society.

THE ASTRONOMER ROYAL, who, in addition to his astronomical duties, is charged with the oversight of what may be called the official meteorological station for London at Greenwich Observatory, has been created a Knight Commander of the Bath, a well-deserved honour, on which we heartily congratulate Sir William Christie.

THE METROPOLITAN BOROUGHS of Holborn and Stepney have followed the excellent example of the City of London, Chelsea and Hackney, in establishing official rain gauges which fill wide gaps in the rainfall system of London. It would not be too much if there was one rain gauge to every square mile of the metropolitan area, where the determination of the exact distribution of heavy rains is often a question of great practical importance, and the examples cited above might well be followed by the other municipalities which are still without observations.

THE ANTARCTIC EXPEDITIONS, under the leadership of Captain R. F. Scott, R.N., C.V.O., on the *Discovery*, and of Mr. W. S. Bruce, on the *Scotia* have returned to this country and the observations and collections are now being worked up. The Royal Society has appointed a committee to co-operate with the Meteorological Council in the reduction and discussion of the meteorological observations of the National Antarctic Expedition.

THE BEN NEVIS OBSERVATORIES ceased work on October 1st, a circumstance which we regard as nothing less than a national calamity. We have in type the report of last year's work at the Observatories, which we hope to publish next month, and we may then have something to say on the unfortunate state of matters which made such a catastrophe possible.

THE SECOND METEOROLOGICAL VOLUME of the International Catalogue of Scientific Literature has just been published. It is a distinct advance on the first volume, but not yet by any means a satisfactory record of the science.

## METEOROLOGY AT THE BRITISH ASSOCIATION.

(CONTINUED).

**Suggested Uniformity of Units for Meteorological Observations and Measurements.**

*The following suggestions adopted by a Committee of the Council of the British Association, were presented by DR. W. N. SHAW.*

It should be premised that international uniformity can be regarded as *urgently* desirable only as regards the units adopted for the publication of results, the preparation of weather maps, &c. This purpose can be attained without requiring uniformity as regards the graduation of instruments used by observers. A change of system for the purpose of publication does not therefore necessarily involve an immediate or general change in the instruments now in use. But as the natural tendency would be to adapt the instruments to give readings in the units used for publication, the question is treated in this memorandum upon that understanding.

Uniformity has been obtained for electrical measurements by the adoption of the C.G.S. system, and due weight should be given to the advantage likely to arise from extending a system which has already proved itself successful.

1. Units of temperature and length are required for meteorological measurements of air temperature and humidity, pressure, rainfall, and wind velocity.

2. Units based on the inch or its multiples and the Fahrenheit degree are employed in the official organisations of the United Kingdom (including British ships of all kinds), India, Australian Commonwealth, South African Colonies, the Crown Colonies and dependencies, including, East, Central, and West Africa, the West Indies and Canada, and in the United States.

Units based on the metre and the Centigrade degree are employed in the official organisations of the Continent of Europe, including Asiatic Russia and the Colonies of France, Germany, Portugal, Holland and Belgium, and the Congo State, Egypt and the Sudan, Argentine, Brazil, Mexico and Japan.

The results for the Philippines are issued in both systems.

3. It may be added that British and American writers in scientific publications occasionally use Centigrade and Metric units, but the converse does not occur.

4. In meteorology the measurements of length are for the most part indirect, and although the substitution of millimetres for inches of rainfall, or of metres per second for miles per hour of wind velocity, might be held to turn upon the general adoption of a metric system, yet it is not unreasonable to consider the meteorological units separately from those of a general system.

5. The distribution of instruments in use on either system is so wide that any change could only be recommended upon reasons which appeal to scientific men in general, and especially to those engaged in the practical applications of science.

6. The choice of units may be approached from two points of view—viz., that of the observer and that of the computer or tabulator.

7. From the point of view of the observer that unit is the best which

employs the fewest figures to represent the reading of the instrument to a practical degree of accuracy; which permits the greatest simplicity of graduation; and which makes the process of reading as nearly as possible identical for every position on the scale.

8. From the point of view of the tabulator and computer, that unit is the best which employs the fewest figures, and which makes the process of computation independent of the position of particular readings on the scale.

9. The most appropriate way of arriving at a selection of a suitable unit is, therefore, to consider—(1) The degree of accuracy practically attainable. (2) The appropriate position for the zero of practical measurement. (3) The number of figures required to represent all the values within the practical range. (4) The mode of graduation of the scale or vernier required for reading.

10. *Air Temperature—Degree of accuracy.*—The limit of practical accuracy of a thermometric reading with a mercury in glass thermometer, making appropriate corrections for change of zero, is fairly represented by  $0^{\circ}\cdot 1$  C. ( $0^{\circ}\cdot 2$  F.). On account of the effect of different methods of exposure and other accidental circumstances, meteorology cannot effectively take account of differences of individual readings of less than  $1^{\circ}$  F., or  $0^{\circ}\cdot 5$  C., as regards air temperature; though as regards the application of temperature readings to the measurement of humidity an accuracy of  $0^{\circ}\cdot 1$  C. ( $0^{\circ}\cdot 2$  F.) is required.

*Position of Zero.*—The zero should be so chosen that all observed or recorded values are positive. Negative values should be regarded as inadmissible; they introduce very serious danger of error both for the observer and computer. The observer has to adopt a different mode of estimating fractions of a scale division in different parts of the scale, and the computer has to change his mode of operation and to use a + and — notation, which is a serious complication.

*Number of Figures.*—The Fahrenheit range  $0^{\circ}$  F. to  $100^{\circ}$  F. covers nearly all temperature readings in temperate climates, but to include all atmospheric temperatures a range of about  $230^{\circ}$  F., from  $-100^{\circ}$  F. to  $+130^{\circ}$  F. would be required; say,  $130^{\circ}$  C. from  $-75^{\circ}$  C. to  $+55^{\circ}$  C. Expressing these on scales measured from absolute zero, a comprehensive range in Fahr. degrees would be from  $360^{\circ}$  to  $590^{\circ}$ , or in Centigrade degrees from  $200^{\circ}$  to  $330^{\circ}$ . With the Centigrade degree, four figures on the absolute scale would give a reading to the practical limit of accuracy; the first figure could almost always be assumed known. In Fahrenheit degrees four figures would go beyond the practical limit of accuracy; the omission of the first figure would be less safe. The freezing point of water would be  $[2]73^{\circ}$  in the one scale,  $[4]91^{\circ}$  in the other.

*Mode of Graduation.*—For the observer divisions of a scale should correspond to digits in the value expressed. Graduation into fifths is liable to cause errors. Estimation should be to a tenth of a division of whatever scale is adopted.

It may be noted that the Fahrenheit degree corresponds almost exactly with the expansion of mercury by the ten-thousandth part, while the Centigrade degree corresponds very nearly with the communication of the heat equivalent of a Joule ( $10^7$  ergs) to a gramme of dry atmospheric air.

11. *Humidity*—This is generally determined from readings of the temperature of the dry and wet bulbs. If any considerable degree of accuracy is

aimed at, the difference of temperature of the two bulbs should be correct to  $0^{\circ}\cdot 1$  C. It is, however, only the difference that is required to be known with that accuracy. The measurements as at present carried out in practice are not in any case altogether satisfactory, for reasons which need not be specified here. The International Committee were unable to include tables for the reduction of readings of the dry and wet bulb in their volume of Meteorological tables.

12. *Pressure.—Degree of Accuracy.*—The practical accuracy of the mercury barometer with skilful setting and reading is  $\cdot 002$  inch to  $\cdot 003$  inch ( $\cdot 05$  to  $\cdot 08$  mm.). For most purposes in temperate latitudes an accuracy of  $\cdot 1$  mm. ( $\cdot 004$  inch) would be sufficient. Telegraphic reports in this country give the nearest hundredth of an inch ( $\cdot 25$  mm.), but in tropical countries the third decimal place is reported ( $\cdot 025$  mm.).

*Position of Zero.*—The barometer is always graduated from zero pressure, so that negative values never arise.

*Number of Figures.*—The range at sea level slightly exceeds that between 28 and 31 inches (710 mm. to 790 mm.). The millimetre scale, with the omission of the first figure, complies fairly well with the conditions indicated if a high degree of accuracy is not required.

*Mode of Graduation.*—In this respect neither system is very appropriate. The usual mode of graduation of the inch barometer is very unsatisfactory; the scale is divided to 20ths of an inch, and the vernier carries the division to the 500th. The observer is expected to add 5 to the figures marked on the vernier, if he is dealing with the higher half of a 10th, and each of his final divisions counts two-thousandths. Errors in barometer readings on these accounts are not infrequent. The system has passed from the laboratory into general practice without sufficient consideration for the fallibility of the observer. On the other hand, a millimetre scale is too crowded for easy reading, and mistakes of a millimetre are occasionally made. Again, a vernier to read to  $\cdot 1$  mm. is too short, and one to read to  $\cdot 01$  mm. is too long. An accuracy equal to that of a thousandth of an inch is obtained with a 40 mm. vernier, but this would give readings in divisions of  $\cdot 025$  mm.

With the decimal notation it is evidently impossible to select a scale and vernier to which no objection can be urged, because, whatever length of division is chosen, verniers used to give 10ths and single 100ths would be too short and too long respectively. Unless some other method than that of the vernier be used, a sub-division of the main scale or of the vernier scale into halves or fifths must be accepted for measurements of the highest accuracy, but it is not necessary for the accuracy of a great number of practical measurements.

If the convenience of the observer alone were taken into account, a scale division somewhat greater than the twentieth of an inch, which is itself a little larger than the millimetre, would give a scale very easy to read. There is no scale in practical use in which this interval corresponds to the successive digits of any decimal place. It is, however, a matter of some interest that the interval corresponds very nearly with 2,000 absolute units of pressure on the C.G.S. system.

Barometric corrections are concerned with temperature, height above sea-level, and latitude. It is in many ways desirable for a reader to be able to

know from the figures themselves whether barometric readings have been corrected for latitude or not. The latitude correction is a small one, and the figures at present give no indication upon the point; but the distinction might easily be made clear if it were understood that pressure data corrected for latitude should be expressed in absolute C.G.S. units. Then if the subject were being approached *de novo* it would be reasonable to suggest the use of what might be called an observer's "degree of pressure,"—viz., a scale of lengths with each division corresponding to 1.5 mm., or about .06 inch (*i. e.*, to 2,000 C.G.S. absolute units in latitude 45°).

Upon such a scale of "degrees of pressure," a  $\frac{1}{10}$ th vernier, or preferably a  $\frac{1}{20}$ th vernier, with alternate divisions omitted, would carry the accuracy of reading to .006 inch, and would define quite satisfactorily the degree of accuracy required in setting and reading for such practical purposes as telegraphic reporting in temperate climates, while a  $\frac{1}{50}$ th vernier would reach the extreme practical limit of accuracy of the mercury barometer under meteorological conditions.

This would give as nearly as can be secured an ideal scale for observing. Reduction to absolute measure would be obtained by the application of the gravity correction and the simple process of multiplication by two.

It is hardly necessary to say that if temperature were directly referred to the absolute zero which is practically the zero of the gas thermometer, and pressure were expressed in absolute C.G.S. units, many of the calculations of the thermal and dynamical properties of gases would be immensely simplified. No confusion would be likely to arise between the observer's "degree of pressure" and the corresponding absolute units because the limited range of readings of pressure at sea-level would be sufficient guide.

The proposals indicated would not affect the mode of procedure in determining the fixed points of a thermometer, which would still be the melting point of ice under certain defined conditions, and the boiling point of water under the pressure of a standard atmosphere, but the melting point would be marked [2]73°, the boiling point [3]73°, and the standard atmosphere would be 506.33 "degrees of pressure," latitude of London, or  $1.01325 \times 10^6$  dynes per sq. cm., which might perhaps be called 1013.25 "kilobars."

13. *Rainfall.*—In this country readings are carried to hundredths, sometimes to thousandths of an inch, but the readings to the higher degree of accuracy have seldom any practical meaning. The range is from .01 to 3, 4, or even more inches in exceptional cases for a day's rain; the large majority of readings are certainly under 2 inches. In metric units 10 cm. would cover all but very exceptional falls, and .1 mm. would represent satisfactorily the highest degree of accuracy.

14. *Wind Velocity.*—The degree of effective accuracy of wind measurement depends much more upon the exposure than on the graduation of the instrument. The mile per hour is a good unit of wind velocity, because a real velocity of one hundred miles is hardly ever, if ever, exceeded, and thus two figures are sufficient, while an accuracy defined by one mile per hour is as much as can be expected to express any velocity. The corresponding range in metres per second extends to forty-five metres per second, and as measurements can be easily made to one mile per hour, less than half a metre per second, three figures would be necessary to express wind velocity in metric units.

THE TEN MONTHS' RAINFALL OF 1904.

*Aggregate Rainfall for January—October, 1904.*

| Stations.             | Total Rain. | Per cent. of Aver. | Stations.         | Total Rain. | Per cent. of Aver. | Stations.       | Total Rain. | Per cent. of Aver. |
|-----------------------|-------------|--------------------|-------------------|-------------|--------------------|-----------------|-------------|--------------------|
|                       | in.         |                    |                   | in.         |                    |                 | in.         |                    |
| London .....          | 17·17       | 92                 | Arncliffe .....   | 44·69       | 91                 | Braemar .....   | 21·74       | 78                 |
| Tenterden .....       | 19·62       | 91                 | Hull .....        | 18·31       | 89                 | Aberdeen .....  | 21·92       | 87                 |
| Hartley Wintney ..... | 20·07       | 98                 | Newcastle.....    | 18·35       | 87                 | Cawdor .....    | 18·75       | 75                 |
| Hitchin .....         | 18·17       | 96                 | Seathwaite ...    | 102·43      | 97                 | Glencarron ...  | 69·70       | 95                 |
| Winslow .....         | 18·98       | 98                 | Cardiff .....     | 36·39       | 116                | Dunrobin .....  | 22·91       | 94                 |
| Westley.....          | 17·39       | 84                 | Haverfordwest     | 34·31       | 102                | Killarney ...   | ...         | ...                |
| Brundall.....         | 16·95       | 83                 | Gogerddan ...     | 36·88       | 105                | Waterford ...   | 35·21       | 113                |
| Alderbury .....       | 23·67       | 108                | Llandudno ...     | 21·13       | 87                 | Broadford.....  | 32·87       | 123                |
| Ashburton .....       | 42·95       | 113                | Dumfries .....    | 32·34       | 93                 | Carlow .....    | 28·29       | 104                |
| Polapit Tamar ...     | 35·08       | 120                | Lilliesleaf ..... | 23·71       | 97                 | Dublin .....    | 19·61       | 88                 |
| Stroud .....          | 23·12       | 106                | Colmonell .....   | 34·20       | 100                | Mullingar.....  | 29·68       | 101                |
| Woolstaston .....     | 22·93       | 97                 | Glasgow .....     | 29·10       | 102                | Ballinasloe ... | 33·09       | 112                |
| Boston .....          | 17·80       | 106                | Inveraray ...     | 57·31       | 102                | Clifden .....   | 67·41       | 106                |
| Hesley Hall .....     | 17·38       | 100                | Islay .....       | 41·40       | 115                | Crossmolina ... | 49·35       | 121                |
| Derby .....           | 17·27       | 91                 | Mull .....        | 49·02       | 111                | Seaforde .....  | 29·15       | 100                |
| Bolton .....          | 27·73       | 81                 | Loch Leven ...    | 28·80       | 101                | Londonderry..   | 33·95       | 102                |
| Wetherby .....        | 21·79       | 110                | Dundee .....      | 22·30       | 102                | Omagh .....     | 36·63       | 114                |

The month of October proved dry generally, and as the correspondence published on another page shows, it was very dry in several localities. With the exception of the South-west of England, South Wales, and the West of Scotland, considerably less than the average rainfall occurred over Great Britain in the first ten months of 1904. The average used in the above Table is that of ten years which were exceptionally dry in most parts of the country, so that the year as far as it had gone promised to be one of unusually low rainfall. The areas where rainfall was most deficient were in the East and North-west of England, and in the North-east of Scotland, and some difficulties as to water supply occurred in these districts, and especially in Manchester. In Ireland the rainfall exceeded the average, except in the immediate vicinity of Dublin. The unprecedentedly wet October of 1903 led to an average excess of 45 per cent. of rainfall for the ten months; the exceptionally dry October this year leads to a deficiency of about 1 per cent. for the ten months, in each case considering the whole area of the British Isles, and taking as a standard the average for the ten years, 1890-99.



RAINFALL AND TEMPERATURE, OCTOBER, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.   |                             |                       |       | Days on which<br>'01 or more fell. | TEMPERATURE. |                 |      |                 | No. of Nights below 32°. |       |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------|-----------------------|-------|------------------------------------|--------------|-----------------|------|-----------------|--------------------------|-------|
|        |                                                                                                                                      | Total Fall. | Diff. from average, 1890-9. | Greatest in 24 hours. |       |                                    | Max.         |                 | Min. |                 | Shade                    | Grass |
|        |                                                                                                                                      |             |                             | Depth                 | Date. |                                    | Deg.         | Date.           | Deg. | Date.           |                          |       |
| I.     | London (Camden Square) ...                                                                                                           | 1.56        | - 1.03                      | .35                   | 6     | 11                                 | 67.1         | 18              | 32.7 | 15              | 0                        | 9     |
| II.    | Tenterden.....                                                                                                                       | 1.98        | - 1.01                      | .47                   | 6     | 14                                 | 68.0         | 18              | 32.2 | 9               | 0                        | 4     |
| „      | Hartley Wintney .....                                                                                                                | 1.73        | - 1.16                      | .53                   | 6     | 12                                 | 66.0         | 18 <sup>a</sup> | 26.0 | 15              | 4                        | 8     |
| III.   | Hitchin .....                                                                                                                        | 1.13        | - 1.44                      | .25                   | 21    | 13                                 | 65.0         | 18, 19          | 28.0 | 14              | 6                        | ...   |
| „      | Winslow (Addington) .....                                                                                                            | .96         | - 1.73                      | .37                   | 16    | 10                                 | 67.0         | 18              | 27.0 | 13, 15          | 3                        | 11    |
| IV.    | Bury St. Edmunds (Westley) .....                                                                                                     | 1.14        | - 1.52                      | .29                   | 16    | 10                                 | 70.5         | 18              | 30.0 | 16              | ...                      | ...   |
| „      | Brundall .....                                                                                                                       | 1.20        | - 1.42                      | .24                   | 1     | 13                                 | 66.2         | 19              | 29.4 | 16              | 1                        | 3     |
| V.     | Alderbury .....                                                                                                                      | 1.72        | - 1.48                      | .63                   | 6     | 8                                  | 60.0         | 11 <sup>b</sup> | 32.0 | 12              | 1                        | ...   |
| „      | Winterborne Steepleton .....                                                                                                         | 2.77        | ...                         | .73                   | 2     | 15                                 | 65.7         | 18              | 31.7 | 13              | 1                        | 10    |
| „      | Torquay (Cary Green) .....                                                                                                           | 2.05        | ...                         | .81                   | 2     | 11                                 | 64.9         | 18              | 40.8 | 8               | 0                        | 0     |
| „      | Polapit Tamar [Launceston] .....                                                                                                     | 2.32        | - 2.22                      | .74                   | 6     | 17                                 | 61.8         | 11              | 30.5 | 26              | 2                        | 3     |
| „      | Bath .....                                                                                                                           | .71         | ...                         | .22                   | 6     | 10                                 | 63.4         | 11              | 34.0 | 13              | 0                        | 10    |
| VI.    | Stroud (Upfield) .....                                                                                                               | .58         | - 2.20                      | .14                   | 16    | ...                                | 64.0         | 18              | 36.0 | 28              | 0                        | ...   |
| „      | Church Stretton (Woolstaston) .....                                                                                                  | .70         | - 2.80                      | .22                   | 15    | 14                                 | 65.5         | 18              | 37.5 | 13              | 0                        | ...   |
| „      | Bromsgrove (Stoke Reformatory) .....                                                                                                 | .60         | - 1.66                      | .19                   | 16    | 9                                  | 65.0         | 18              | 29.0 | 12              | 6                        | ...   |
| VII.   | Boston .....                                                                                                                         | .91         | - 1.36                      | .24                   | 23    | 9                                  | 66.0         | 21              | 30.0 | 15              | ...                      | ...   |
| „      | Bawtry (Hesley Hall) .....                                                                                                           | .32         | - 2.25                      | .15                   | 9     | 7                                  | 64.0         | 17              | 26.0 | 17              | 12                       | ...   |
| „      | Derby (Midland Railway) ...                                                                                                          | .55         | - 1.99                      | .33                   | 16    | 10                                 | 67.0         | 18              | 28.0 | 12              | 3                        | ...   |
| VIII.  | Bolton (The Park) .....                                                                                                              | 2.90        | - 1.66                      | 1.21                  | 16    | ...                                | 58.9         | 4               | 35.1 | 3               | 0                        | 3     |
| IX.    | Wetherby (Ribston Hall) ...                                                                                                          | .72         | - 2.08                      | .16                   | 9     | 9                                  | ...          | ...             | ...  | ...             | ...                      | ...   |
| „      | Arnccliffe Vicarage .....                                                                                                            | 2.92        | - 3.72                      | .85                   | 16    | 13                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| „      | Hull (Pearson Park) .....                                                                                                            | .50         | - 2.54                      | .12                   | 9     | 11                                 | 65.0         | 11, 18          | 30.0 | 9               | 4                        | 10    |
| X.     | Newcastle (Town Moor) ...                                                                                                            | .81         | - 1.91                      | .28                   | 5     | 10                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| „      | Borrowdale (Seathwaite) ...                                                                                                          | 9.19        | - 4.23                      | 4.03                  | 16    | 16                                 | 59.5         | 19              | 32.3 | 31              | 1                        | ...   |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 2.69        | - 1.74                      | .84                   | 16    | 17                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| „      | Haverfordwest (High St.) ..                                                                                                          | 2.25        | - 2.83                      | .95                   | 16    | 15                                 | 62.5         | 4               | 33.3 | 25              | 0                        | 7     |
| „      | Aberystwith (Gogerddan) ..                                                                                                           | 3.23        | - 2.33                      | 1.61                  | 16    | 11                                 | 71.0         | 27              | 32.0 | 15 <sup>d</sup> | 3                        | ...   |
| „      | Llandudno .....                                                                                                                      | 1.29        | - 2.71                      | .46                   | 16    | 13                                 | 64.0         | 18              | 36.8 | 15              | 0                        | ...   |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 2.28        | - 2.15                      | .72                   | 16    | 10                                 | 59.0         | 3 <sup>c</sup>  | 30.0 | 13, 14          | 3                        | ...   |
| XIII.  | Edinburgh (Royal Observy.) ..                                                                                                        | .54         | ...                         | .22                   | 5     | 9                                  | 57.9         | 21              | 56.8 | 8               | 0                        | 5     |
| XIV.   | Colmonell .....                                                                                                                      | 2.59        | - 1.75                      | .78                   | 16    | 15                                 | 64.0         | 2               | 31.0 | 12 <sup>e</sup> | 3                        | ...   |
| XV.    | Tighnabruach .....                                                                                                                   | 3.45        | ...                         | .76                   | 5     | 18                                 | 55.0         | 19              | 32.0 | 12              | 1                        | 1     |
| „      | Mull (Quinish) .....                                                                                                                 | 5.30        | - .27                       | .94                   | 5     | 23                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 1.85        | - 1.72                      | .71                   | 6     | 12                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| „      | Dundee (Eastern Necropolis) ..                                                                                                       | .70         | - 2.06                      | .40                   | 5     | 11                                 | 59.7         | 19              | 29.7 | 13              | 1                        | ...   |
| XVII.  | Braemar .....                                                                                                                        | 1.29        | - 2.59                      | .50                   | 5     | 13                                 | 58.8         | 26              | 22.6 | 13              | 7                        | ...   |
| „      | Aberdeen (Cranford) .....                                                                                                            | 1.03        | - 2.33                      | .30                   | 5     | 15                                 | 63.0         | 20              | 27.0 | 12              | 3                        | ...   |
| „      | Cawdor (Budgate) .....                                                                                                               | 1.33        | - 1.61                      | .43                   | 5     | 15                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| XVIII. | Glencarron Lodge .....                                                                                                               | 7.07        | - 2.22                      | 1.42                  | 5     | 26                                 | 57.5         | 21              | 31.0 | 13              | ...                      | ...   |
| „      | Bendamp. ....                                                                                                                        | 7.39        | - 1.75                      | 1.11                  | 16    | 25                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| XIX.   | Dunrobin Castle .....                                                                                                                | 1.82        | - 1.46                      | .57                   | 5     | 13                                 | 62.0         | 4               | 36.5 | 24              | 0                        | ...   |
| „      | Castletown .....                                                                                                                     | 3.27        | ...                         | .75                   | 5     | 25                                 | 59.0         | 20              | 32.0 | 12, 13          | 1                        | ...   |
| XX.    | Killarney .....                                                                                                                      | ...         | ...                         | ...                   | ...   | ...                                | ...          | ...             | ...  | ...             | ...                      | ...   |
| „      | Waterford (Brook Lodge) ...                                                                                                          | 1.74        | - 2.16                      | .49                   | 15    | 16                                 | 64.5         | 18              | 32.0 | 25              | 1                        | ...   |
| „      | Broadford (Hurdlestown) ...                                                                                                          | 3.15        | + .05                       | 1.08                  | 16    | 16                                 | 60.0         | 21              | 33.0 | 24              | 0                        | ...   |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 1.51        | - 1.89                      | .57                   | 16    | 17                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| „      | Dublin (Fitz William Square) ..                                                                                                      | .45         | - 2.58                      | .22                   | 16    | 11                                 | 64.0         | 21              | 34.3 | 27              | 0                        | 0     |
| XXII.  | Ballinasloe .....                                                                                                                    | 2.77        | - .63                       | 1.00                  | 16    | 20                                 | 66.0         | 5               | 30.0 | 12              | 4                        | ...   |
| „      | Clifden (Kylemore House) ..                                                                                                          | 4.92        | - 3.02                      | 2.12                  | 16    | 15                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| XXIII. | Seaforde .....                                                                                                                       | .85         | - 2.74                      | .24                   | 15    | 16                                 | 62.0         | 17              | 26.0 | 10 <sup>f</sup> | ...                      | ...   |
| „      | Londonderry (Creggan Res.) ..                                                                                                        | 2.80        | - 1.28                      | .63                   | 22    | 25                                 | ...          | ...             | ...  | ...             | ...                      | ...   |
| „      | Omagh (Edenfel) .....                                                                                                                | 3.51        | - .40                       | .80                   | 27    | 21                                 | ...          | ...             | ...  | ...             | ...                      | ...   |

+ Shows that the fall was above the average; - that it was below it. a and 19, 21. b and 12, 19. c and 17, 18. d and 24, 26. e and 29, 30. f and 12, 29.

## SUPPLEMENTARY RAINFALL, OCTOBER, 1904.

| Div.  | STATION.                       | Rain.<br>inches | Div.   | STATION.                     | Rain.<br>inches |
|-------|--------------------------------|-----------------|--------|------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....    | 2·50            | XI.    | New Radnor, Ednol .....      | 1·38            |
| „     | Sheppey, Leysdown .....        | 1·66            | „      | Rhayader, Nantgwilt .....    | 2·97            |
| „     | Hailsham .....                 | 2·08            | „      | Lake Vyrnwy .....            | 2·13            |
| „     | Crowborough .....              | 2·80            | „      | Ruthin, Plâs Drâw.....       | 1·61            |
| „     | Ryde, Beldornie Tower.....     | 2·15            | „      | Criccieth, Talarvor.....     | 1·58            |
| „     | Emsworth, Redlands.....        | 2·46            | „      | Anglesey, Lligwy .....       | 2·17            |
| „     | Alton, Ashdell .....           | 2·12            | „      | Douglas, Woodville .....     | 2·16            |
| „     | Newbury, Welford Park ...      | 1·60            | XII.   | Stoneykirk, Ardwell House    | 2·13            |
| III.  | Harrow Weald .....             | 1·62            | „      | Dalry, Old Garroch .....     | 3·70            |
| „     | Oxford, Magdalen College..     | ·74             | „      | Langholm, Drove Road.....    | 2·57            |
| „     | Banbury, Bloxham... ..         | ·61             | „      | Moniaive, Maxwellton House   | 2·24            |
| „     | Pitsford, Sedgebrook .....     | ·67             | „      | Lilliesleaf, Riddell .....   | ·96             |
| „     | Huntingdon, Brampton.....      | 1·14            | XIII.  | N. Esk Reservoir [Penicuik]  | 1·40            |
| „     | Wisbech, Bank House .....      | 1·35            | XIV.   | Maybole, Knockdon Farm..     | 1·67            |
| IV.   | Southend .....                 | 2·04            | „      | Glasgow, Queen's Park .....  | 1·73            |
| „     | Colchester, Lexden.....        | ·75             | XV.    | Inveraray, Newtown .....     | 5·69            |
| „     | Saffron Waldon, Newport...     | 1·13            | „      | Ballachulish, Ardsheal ..... | 6·45            |
| „     | Rendlesham Hall .....          | 1·01            | „      | Campbeltown, Redknowe...     | 2·84            |
| „     | Swaffham .....                 | 1·14            | „      | Islay, Eallabus .....        | 4·45            |
| „     | Blakeney .....                 | 1·25            | XVI.   | Dollar .....                 | 1·54            |
| V.    | Bishop's Cannings .....        | 1·37            | „      | Balquhider, Stronvar .....   | 4·29            |
| „     | Ashburton, Druid House ...     | 2·82            | „      | Coupar Angus Station .....   | ·96             |
| „     | Okehampton, Oaklands.....      | 3·09            | „      | Blair Atholl.....            | ·91             |
| „     | Hartland Abbey .....           | 3·48            | „      | Montrose, Sunnyside.....     | ·78             |
| „     | Lynmouth, Rock House .....     | 2·50            | XVII.  | Alford, Lynturk Manse .....  | 1·15            |
| „     | Probus, Lamellyn .....         | 2·38            | „      | Keith, H.R.S.....            | 2·15            |
| „     | Wellington, The Avenue ...     | 1·55            | XVIII. | Fearn, Lower Pitkerrie.....  | 1·65            |
| „     | North Cadbury Rectory .....    | 2·77            | „      | S. Uist, Askernish .....     | ...             |
| VI.   | Clifton, Pembroke Road ...     | 1·37            | „      | Invergarry .....             | 3·85            |
| „     | Moreton-in-Marsh, Longboro'    | ·86             | „      | Aviemore, Alvie Manse.....   | 1·83            |
| „     | Ross, The Graig .....          | ·55             | „      | Loch Ness, Drumnadrochit.    | 1·74            |
| „     | Shifnal, Hatton Grange.....    | ·83             | XIX.   | Invershin .....              | 2·38            |
| „     | Wem Rectory .....              | ·76             | „      | Altnaharra .....             | 2·94            |
| „     | Cheadle, The Heath House.      | 1·16            | „      | Bettyhill .....              | 3·09            |
| „     | Coventry, Kingswood .....      | ·57             | „      | Watten, H.R.S. ....          | 1·70            |
| VII.  | Market Overton .....           | ·64             | XX.    | Cork, Wellesley Terrace ...  | 3·06            |
| „     | Market Rasen .....             | ·69             | „      | Darrynane Abbey .....        | 5·39            |
| „     | Worksop, Hodsock Priory..      | ·32             | „      | Glenam [Clonmel] .....       | 2·30            |
| VIII. | Neston, Hinderton.....         | 1·27            | „      | Ballingarry, Hazelfort ..... | 2·26            |
| „     | Southport, Hesketh Park...     | 1·99            | „      | Miltown Malbay.....          | 4·24            |
| „     | Chatburn, Middlewood .....     | 2·46            | XXI.   | Gorey, Courtown House ...    | 1·23            |
| „     | Duddon Valley, Seathwaite Vic. | 4·64            | „      | Moynalty, Westland .....     | 1·64            |
| IX.   | Langsett Moor, Up. Midhope     | 1·10            | „      | Athlone, Twyford .....       | 3·23            |
| „     | Baldersby .....                | ·57             | „      | Mullingar, Belvedere.....    | 2·50            |
| „     | Scalby, Silverdale .....       | ·79             | XXII.  | Woodlawn .....               | 3·47            |
| „     | Ingleby Greenhow .....         | ·53             | „      | Westport, Murrisk Abbey..    | 3·65            |
| „     | Middleton, Mickleton .....     | 1·03            | „      | Crossmolina, Enniscoo .....  | 2·98            |
| X.    | Beltingham .....               | ·67             | „      | Collooney, Markree Obsy...   | 2·68            |
| „     | Bamburgh .....                 | ·93             | XXIII. | Enniskillen, Portora .....   | 2·57            |
| „     | Keswick, The Bank .....        | 3·10            | „      | Warrenpoint .....            | ·87             |
| „     | Melmerby Rectory.....          | 1·55            | „      | Banbridge, Milltown .....    | ·67             |
| XI.   | Llanfrecfha Grange .....       | 1·38            | „      | Belfast, Springfield .....   | 1·26            |
| „     | Treherbert, Tyn-y-waun ...     | 5·45            | „      | Bushmills, Dundarave .....   | 2·56            |
| „     | Llandoverly, Tonn .....        | ...             | „      | Stewartstown .....           | 1·55            |
| „     | Castle Malgwyn .....           | 1·79            | „      | Killybegs .....              | 3·42            |
| „     | Llandefaelog-fach .....        | 1·98            | „      | Horn Head .....              | ...             |

## METEOROLOGICAL NOTES ON OCTOBER, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

## ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The weather was generally of an anticyclonic type and fairly free from R, although mostly lacking in sunshine. The first eleven days were dull with some fog, especially the 11th, when it was very dark at times. From 12th to 15th it was fine and bright and cooler, but it became heavy and foggy again from 16th to the last week, which was somewhat finer and cooler. Duration of sunshine 56·2\* hours and of R 54·2 hours. Mean temp. 51°·0, or 1°·2 above the average.

TENTERDEN.—Warm, and decidedly dry after the first week. Duration of sunshine only 100·6† hours. Dull from 17th to 24th, with fog all day on 19th.

CROWBOROUGH.—Cool and pleasant on the whole, with gales on 5th and 17th. Mean temp. 50°·0.

HARTLEY WINTNEY.—Extremely pleasant, summer weather continuing into the third week, and unusually high temp. The last week was colder and foggy.

ADDINGTON MANOR.—Very fine, with the smallest R in any October except three during 34 years.

PITSFORD.—Very fine, bright and still. R 2·35 in. below the average. Mean temp. 47°·6.

BURY ST. EDMUNDS.—A lovely mild autumnal month, with R much below the average. Water became scarce and ponds were nearly dry.

BRUNDALL.—A very fine month. Mean temp. 1°·8 above the average, and max. above 60° on ten days.

TORQUAY, CARY GREEN.—R 1·99 in. below the average. Duration of sunshine 90·6\* hours, or 23·4 hours below the average. Mean temp. 53°·7 or 1°·8 above the average. Mean amount of ozone 4·4. Max. 9·0 on 3rd with E.N.E. wind, min. 2·0 on several days.

LYNMOUTH.—Mild with an average amount of sunshine till 23rd. No violent gales or extremes of temp. All the heavy R fell in the night.

WELLINGTON.—Remarkably fine and dry, with little rough weather. R only about half the normal.

NORTH CADBURY.—Temp. very equable throughout, the latter half of the month being the warmer. There was no strong wind.

CLIFTON.—Mostly anticyclonic, and with the exception of a rainy spell from 5th to 10th and on 16th and 17th, and of S.W. gales on 5th and 17th, a fine calm and pleasant month. Some fog in the last week. R little more than one-third of the average.

ROSS.—The driest October in 86 years, except in 1830, when ·53 in. fell, and a perfect contrast to 1903, when R fell on every day amounting to 7·40 in. Most tender plants were uninjured at the close and the autumn tints were exceedingly beautiful.

WOOLSTASTON.—Exceptionally warm and dry. On the 22nd there was an earthquake at 10·45 p.m., followed by a slighter shock between 2 and 3 a.m. on the following morning. The noise resembled that made by a heavy dray.

BOLTON.—Fair and mild, with sunshine slightly above the average. Except for a N.W. gale on 5th and 6th the winds were very light. Slight fog occurred on four days and night mists were frequent in the latter part, which probably had much to do with causing the singularly mild weather.

SOUTHPORT.—Dry and sunny with unusually high bar. pressure. Mean temp. 1°·7 above the average. Duration of sunshine 21 hours above the average. R 1·92 in. below the average, and underground water-level unusually low.

\* Campbell-Stokes.

† Jordan.

**HULL.**—Very light R and some fine mild weather. Stormy on 5th and 6th. Fog frequently.

**NEWCASTLE.**—The lowest R in October since 1868, except .63 in. in 1879, whereas 1903 had the greatest amount, 9.24 in.

**LLANFRECHFA GRANGE.**—Calm, with gradually falling temp. and some fog. The R fell chiefly at night, and the weather was very favourable for agriculture.

**HAVERFORDWEST.**—Fine and mild, with small R and generally high temp. The wind reached the force of a gale on 3 days, but the last 10 days were calm. Duration of sunshine 71.7\* hours.

**DOUGLAS.**—A singularly beautiful month and certainly the best October for 30 years, with moderate R, unusual calmness and excess of sunshine. Temp. above the average in the last two weeks. Gales on 5th and 16th.

### SCOTLAND.

**CARGEN [DUMFRIES].**—One of the driest and warmest Octobers on record. A truly "record" year in matters agricultural.

**LILLIESLEAF.**—Lovely weather, like a cool summer, with little R, and splendid for getting in potatoes, of which there was a capital crop.

**COLMONELL.**—The first week was rather stormy, with a strong gale on 5th and 6th. Mean temp. 48°.8, or 2°.2 above the average of 28 years.

**MULL, QUINISH.**—The R fell generally at night, and the weather showed a wonderful aptitude for clearing up. Very mild from 18th to 21st and at the end. N.W. gale on 4th.

**ABERDEEN.**—Fine and dry, with light wind from W. and S.W. and much sunshine.

**DRUMNADROCHIT.**—The R was less than half the average of 18 years and the lowest in October in that period.

**ALTNAHARRA.**—Exceptionally fine, mild and dry, and particularly calm, mild and clear towards the end.

**CASTLETOWN.**—Strong winds from W. till 10th, with heavy showers of R and often H. From 23rd to the end, high bar., overcast skies, damp atmosphere and light variable winds. Much cloud throughout.

### IRELAND.

**DARRYNANE ABBEY.**—Fine on the whole with some very fine days especially in the latter half. R 9.3 per cent. below the average of 25 years. More than half the total fell on 3 days.

**DUBLIN.**—Dull, yet fine and mild, with high bar., a deficiency of bright sunshine and a damp atmosphere but a singularly scanty R, which established a record drought for October. There was very little cold weather, but transitory cold snaps on 3rd, 13th and 27th, connected with anticyclonic conditions.

**MARKREE OBSERVATORY.**—A very dry month. The nights were generally cloudy and the weather mild and fine on the whole.

**BANBRIDGE.**—R 2.33 in. below the average of 40 years, and the least since the gauge was established in 1862.

**OMAGH.**—Although the R was close to the average it fell mostly at night and was accompanied by anticyclonic conditions and temp. above the average throughout. It therefore left the feeling that for many years so agreeable an autumn month has not been experienced. The natural maturing of the tints, owing to the almost complete absence of frost, resulted in a display of foliage not often equalled.

Climatological Table for the British Empire, May, 1904.

| STATIONS.<br><br><i>(Those in italics are South of the Equator.)</i> | Absolute. |       |          |       | Average. |      |            |           | Absolute.    |                | Total Rain. |       |        | Aver.<br>Cloud. |
|----------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|------------|-----------|--------------|----------------|-------------|-------|--------|-----------------|
|                                                                      | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth.      | Days. | Cloud. |                 |
|                                                                      | Temp.     | Date. | Temp.    | Date. |          |      |            |           |              |                |             |       |        |                 |
| London, Camden Square                                                | 76·6      | 16    | 34·1     | 9     | 63·4     | 46·7 | 47·8       | 80        | 123·4        | 28·0           | inches      | 1·96  | 16     | 7·3             |
| Malta.....                                                           | 90·2      | 23    | 52·3     | 1     | 78·9     | 58·4 | 59·1       | 78        | 138·1        | 48·9           | ·00         | 0     | 1·4    |                 |
| Lagos, W. Africa .....                                               | ...       | ...   | ...      | ...   | ...      | ...  | ...        | ...       | ...          | ...            | ...         | ...   | ...    |                 |
| Cape Town .....                                                      | 75·6      | 4     | 44·9     | 15b   | 65·1     | 51·5 | 52·6       | 82        | ...          | ...            | 3·37        | 14    | 5·0    |                 |
| Durban, Natal .....                                                  | 91·2      | 7     | 50·4     | 10    | 79·2     | 58·2 | ...        | ...       | 143·1        | ...            | ·44         | 8     | 2·0    |                 |
| Mauritius.....                                                       | 81·7      | 1     | 57·1     | 31    | 79·0     | 64·9 | 65·1       | 81        | 142·1        | 50·1           | 3·59        | 18    | 4·5    |                 |
| Calcutta.....                                                        | 98·1      | 19    | 68·1     | 12    | 93·3     | 76·7 | 74·9       | 75        | 156·0        | 67·6           | 9·84        | 7     | 5·1    |                 |
| Bombay.....                                                          | 92·3      | 30    | 78·2     | 1     | 91·2     | 81·0 | 75·9       | 73        | 141·0        | 72·8           | ·02         | 1     | 2·9    |                 |
| Madras .....                                                         | 102·7     | 14    | 74·6     | 24    | 95·9     | 79·4 | 74·0       | 71        | 147·6        | 71·6           | ·92         | 3     | 4·0    |                 |
| Kodaikanal .....                                                     | 76·3      | 3     | 51·6     | 7     | 68·4     | 54·3 | 51·6       | 74        | 146·1        | 42·6           | 7·64        | 26    | 6·2    |                 |
| Colombo, Ceylon.....                                                 | 89·4      | 8     | 68·5     | 23    | 86·7     | 78·1 | 75·2       | 83        | 152·6        | 66·0           | 9·27        | 19    | 7·0    |                 |
| Hongkong.....                                                        | 88·7      | 2     | 63·1     | 7     | 80·8     | 71·8 | 70·2       | 83        | 137·9        | ...            | 7·71        | 16    | 7·3    |                 |
| Melbourne.....                                                       | 77·8      | 13    | 35·9     | 25    | 61·4     | 46·5 | 47·2       | 75        | 132·9        | 28·9           | 2·56        | 16    | 5·7    |                 |
| Adelaide .....                                                       | 81·7      | 13    | 36·9     | 24    | 67·3     | 49·9 | 48·4       | 71        | 132·8        | 29·7           | 3·00        | 13    | 4·0    |                 |
| Coolgardie .....                                                     | 83·0      | 10a   | 33·8     | 28    | 67·4     | 47·2 | 43·6       | 61        | 148·4        | 25·3           | 1·51        | 9     | 5·2    |                 |
| Sydney .....                                                         | 76·2      | 6     | 44·4     | 25    | 65·2     | 53·9 | 51·6       | 84        | 112·0        | 33·0           | 5·20        | 28    | 5·5    |                 |
| Wellington .....                                                     | 68·2      | 10    | 38·9     | 4     | 59·9     | 46·2 | 45·0       | 74        | 117·0        | 34·0           | 4·59        | 15    | 6·7    |                 |
| Auckland .....                                                       | 66·0      | 24    | 42·0     | 29    | 61·8     | 50·3 | 50·0       | 72        | 122·0        | 29·0           | 1·01        | 10    | 5·0    |                 |
| Jamaica, Negril Point..                                              | 87·8      | 31    | 68·7     | 27    | 85·3     | 73·0 | 72·1       | 75        | ...          | ...            | 6·45        | 8     | ...    |                 |
| Trinidad .....                                                       | 91·0      | 13    | 65·9     | 9     | 87·8     | 68·6 | 71·8       | 80        | 163·0        | 62·0           | 2·76        | 13    | ...    |                 |
| Grenada.....                                                         | 86·4      | 19    | 71·6     | 21    | 83·6     | 73·8 | 69·3       | 73        | 146·0        | ...            | 3·26        | 15    | 3·0    |                 |
| Toronto .....                                                        | 76·9      | 25    | 35·0     | 11    | 64·4     | 46·4 | 46·7       | 72        | 106·2        | 26·8           | 3·80        | 11    | 5·7    |                 |
| Fredericton .....                                                    | 80·8      | 8     | 30·0     | 2     | 67·1     | 42·2 | 40·1       | 56        | ...          | ...            | 4·16        | 10    | 5·6    |                 |
| Winnipeg .....                                                       | 84·0      | 20    | 22·0     | 14    | 67·3     | 39·7 | ...        | ...       | ...          | ...            | 1·77        | 8     | 5·0    |                 |
| Victoria, B.C. ....                                                  | 73·2      | 12    | 40·3     | 1     | 59·7     | 46·0 | ...        | ...       | ...          | ...            | ·49         | 9     | 6·0    |                 |
| Dawson .....                                                         | 67·5      | 31    | 25·0     | 7     | 55·5     | 34·7 | ...        | ...       | ...          | ...            | ·96         | 7     | 4·4    |                 |

a and 12. b and 25.

MALTA.—Mean temp. of air 66°·8 or 2°·8 above the average. Mean hourly velocity of wind 2·9 miles below average. Mean temp. of sea 69°·1.

Mauritius.—Mean temp. of air 0°·7, dew point 0°·2, and R ·11 in. below averages. Mean hourly velocity of wind 8·0 miles, or 2·3 below average.

MADRAS.—Temp. below normal; R below average. Bright sunshine on 197·2 hours, or 51·2 per cent. of possible; TS on 2 days; dust storm on 7th.

KODAIKANAL.—Bright sunshine 162 hours; numerous TSS, many with H.

COLOMBO.—Mean temp. of air 81°·9, or 0°·5 below, of dew point 0°·2 below, R 2·85 in. below, averages. Mean hourly velocity of wind 9 miles, prevailing direction S. W.

HONGKONG.—Mean temp. of air 75°·6. Sunshine 148·0 hours. Mean hourly velocity of wind 12·8 miles, prevailing direction E. by S.

Adelaide.—Mean temp. of air 1°·0 above, R ·26 in. above averages for 47 years.

Wellington.—Mean temp. of air 1°·5 above, and R 4·36 in. below, averages.

TRINIDAD.—R 1·17 in. below the 40 years average.

# Symons's Meteorological Magazine.

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## THE FROST AND SNOW OF NOVEMBER, 1904.

WINTER commenced with unusual suddenness and intensity in the beginning of the last week of November, when more snow fell in London at any rate than during the whole of the winter 1903-4. After three weeks of mild, gloomy and in places foggy weather, a week of wintry conditions set in over the whole country. Coincident with the passage of a cyclonic system over the British Isles in an easterly direction on the 21st, there was a spell of sharp frost, accompanied in most places by snow. In London the temperature began to fall decidedly on the 21st, and from that date frost occurred nightly at Camden Square until the 29th. The lowest air temperature recorded was  $24^{\circ}\cdot 1$  in the screen on the morning of the 26th and the lowest radiation temperature  $16^{\circ}\cdot 5$  on grass on the 27th, though a lower grass reading might have been obtained on the 23rd had the thermometer not been covered by snow. The maximum temperature was as low as  $33^{\circ}\cdot 2$  on the 24th, on which day the mean temperature only reached  $28^{\circ}\cdot 8$ . A slight sprinkling of snow fell in London on the morning of the 22nd, and from 10 to 11.30 p.m. on the 23rd it snowed heavily, rather more than an inch falling, and this continued to lie on the ground melting very slowly till the 30th.

The frost was felt with much greater severity over large tracts of Great Britain than in London, and several instances of temperatures below  $10^{\circ}$  have been reported. In the following notes we take advantage of the observations published by the Meteorological Office as well as those reported by rainfall observers. The earliest notably low readings occurred at Wick and Nairn, which registered  $15^{\circ}$  and  $12^{\circ}$  respectively on the morning of the 22nd. On the 23rd minimum readings were reported of  $6^{\circ}$  at Bromsgrove and  $13^{\circ}$  at Derby; on the 24th,  $6^{\circ}$  again at Bromsgrove and Winslow,  $11^{\circ}$  at Ross,  $12^{\circ}$  at Boston and  $13^{\circ}$  at Nottingham; on the 25th,  $6^{\circ}\cdot 9$  at Polapit Tamar, near Launceston, and  $15^{\circ}$  at Nottingham; and on the 26th,  $7^{\circ}\cdot 3$  at Braemar. At Hodsock Priory, Worksop, a reading of  $-1^{\circ}\cdot 9$  on grass was recorded on the 24th, and at Winslow  $2^{\circ}\cdot 0$  on the same day. The frost seems to have been felt in its greatest severity over the English Midlands, where it is generally referred to as the most severe in November for at least twenty years; at Bassingham, in western Lincolnshire, it is said to have been unparalleled since the Crimean

winter of 1854. The temperatures quoted above, though believed to be taken by accurate instruments, cannot all be absolutely relied on, and we may here repeat the warning that so few amateur observers regard—namely, that a minimum thermometer without a Kew certificate is not worth reading or recording. In spite of the severity of the frost, skating and curling were only possible in a few localities owing to the short duration of the cold weather.

Snow commenced in the north of Scotland on the 19th and in a few places in the extreme north on the 18th. It became fairly general over Scotland, the greater part of Ireland and the north of England on the 20th, continuing on the 21st and 22nd and coming further south each day. With the exception of a strip along the south coast of England, where no snow fell, practically the whole of the kingdom had a heavy fall on the 23rd, and in the Highlands and Northumberland it fell again on the 24th and in a few instances on the 25th. The total depth varied from nothing in the south and south-east of England and not much more than an inch in the neighbourhood of London to as much as 18 inches in the Lake District, where drifts 10 feet deep were heaped up in some places. Considerably more than a foot fell over the Derbyshire uplands, sometimes drifting to 6 and 7 feet, while in the valleys the average depth was about 8 inches. Some 20,000 quarrymen and outdoor workers are said to have been thrown out of employment in the Peak District. Over the northern counties of England and the south of Scotland 8 or 9 inches seems to have been general, and 14 inches is reported at Beltingham, near Haltwhistle, 13 inches at Langholm and a foot at Castle Douglas.

Railway traffic was seriously disorganized, the drifts reaching 5 and 6 feet in depth, and trains had in some cases to be dug out. Several parishes in Scotland missed the usual postal delivery on the 22nd, and at many places the storm formed almost a blizzard on the night of the 21st, and so rapid was the fall that near Arbroath, from 9 to 18 inches fell in an hour or two. In consequence, many sheep were lost on the hills, and shepherds were obliged to search for them with the help of long poles. The heavy fall was mainly confined to the inland country, and on the coast from Anglesey to Lancaster the amount was trifling. At Bamburgh, some ten miles south of Berwick, the ground was never white for more than a few hours at a time. In the southern part of England, and in Wales, the heaviest falls took place over Snowdonia, the Radnor Hills, where 5 inches fell, and in the Cornish peninsula, where 3 inches fell on the west coast, a locality in which snow is a rare phenomenon. At Liskeard 7 inches was the depth, and at Tavistock 3 or 4 inches. About 3 inches also fell at Birmingham, and at Alcester drifts were several feet deep on the 22nd. Little snow fell in North Devon (except on Exmoor), Somerset, Wilts, Dorset, South Hampshire, and the greater part of Kent, and from 1 to 2 inches was general over the remainder of the country. The fall was fairly uniform over Ireland,

varying from some 2 inches in the south-west to very little at Westport.

We have made an attempt to represent the snowfall on a map, but have not received a sufficient number of definite statements as to the depth which fell, to make it worth publishing. If those of our readers who have not reported the depth of undrifted snow on the ground between November 19th and 24th will send in the information it may be possible to complete the map for publication in *British Rainfall*, 1904.

### Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

#### THE SEVERE COLD IN NOVEMBER, 1904.

YESTERDAY (November 24th) was the coldest day in my memory or registers, the nearest approach to such severity in November being November 24th, 1858. This, though very severe also, did not equal 1904 by several degrees. Other low temperatures here occurred on November 30th and December 1st, 1896, and November 27th and 28th, 1890, as the following comparison will show. The instruments in Stevenson's screen were tested by Mr. Marriott this year, and on the other two occasions had been recently properly corrected, so that you may consider them as very closely accurate :—

|               | Max.  | Min. | Mean. | Grass.                          | Wind.    | Snow or<br>Rain.<br>in. | Weather.                      |
|---------------|-------|------|-------|---------------------------------|----------|-------------------------|-------------------------------|
| Nov. 30, 1896 | 35°0  | 20°5 | 27°75 | 17°7                            | N.E. 1   | 00                      | Cloudless, freezing all day.  |
| Dec. 1, 1896  | 38·8  | 21·0 | 29·90 | 20·5                            | N.E. 1   | ·17                     | Cloudy, rain even.            |
| Nov. 27, 1890 | 32·0  | 22·8 | 27·40 | 18·0                            | N.E.E. 1 | ·018                    | Cloudless, snow evening.      |
| „ 28, 1890    | 30·7  | 25·1 | 27·90 | 21·0                            | N.N.E. 1 | ·078                    | Thickly overcast.             |
| „ 24, 1904    | 30·0  | 11·1 | 20·55 | Grass ther.<br>covered<br>snow. | N.W. 1   | ·108                    | Ground covered 2 inches snow. |
| „ 25, 1904    | 37·0? | 13·9 | ?     | ?                               | ...      | ...                     | Ditto, warmer midday.         |

I notice in *Meteorological Magazine*, 1890, page 161, that the lowest temperatures in November at Camden Square are given, but that then in a small district in Surrey lower temperatures were recorded than here at Ross in 1904, especially at Shirley and Addington.

This year the region of lowest readings would probably lie in a small area with Worcester as its approximate centre; but the only readings I have noticed are at Worcester and Leicester, apparently one degree each colder than Ross.

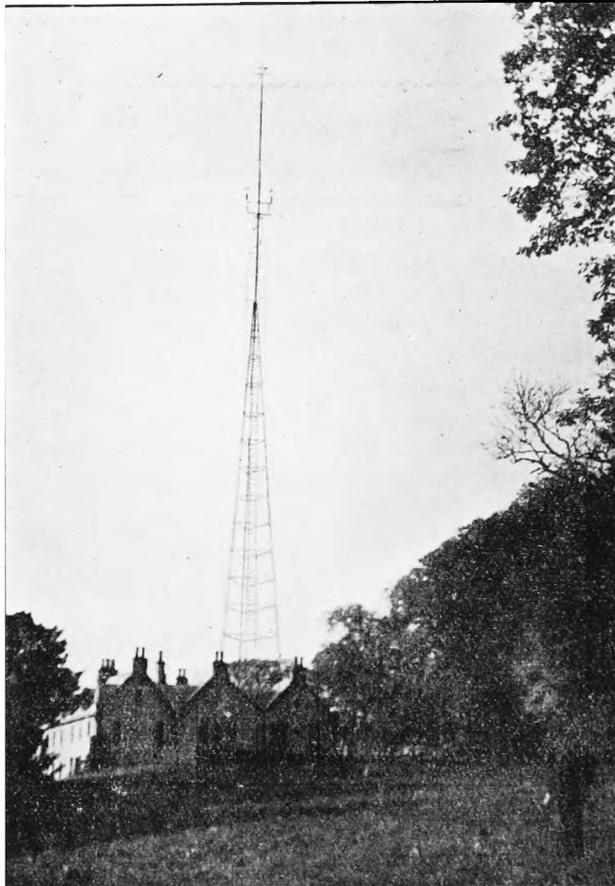
We had a heavy squall of rain passing rapidly over us about 3 to 4 p.m. on Tuesday, 22nd, and a fall of snow of about two inches Wednesday, 23rd, followed by the severe frost with fog on the 24th.

HENRY SOUTHALL.

*The Graig, Ross, Herefordshire, Nov. 25th, 1904.*

**THE TALLEST ANEMOMETER POST.**

ALONG with this I send you the photograph of a steel flagstaff I have erected at Riddell for my instruments, which might interest some of your readers if a photogravure was made of it for the Magazine.



STEEL FLAGSTAFF AT RIDDELL, LILLIESLEAF, N.B.

The flagstaff was exhibited at the last Glasgow Exhibition, and it seemed to me so suitable that I purchased and erected it at one corner of the bowling green in front of my house. It has been up a year now. It is most beautifully made, extremely graceful, and of the finest possible material. From the bowling green to the top is 130 ft., which, I am told, is the highest flagstaff in the United Kingdom. On the lower rail is the following inscription:—"In Memoriam. This flagstaff, a steel one, which was made in Canada

and exhibited at the Glasgow Exhibition of 1901, was purchased by Lieut.-General Sprot of Riddell, and erected by him on this site on the 22nd of August, 1903, to commemorate the Coronation of King Edward VII. on the 9th of August, 1902, and his coming to Edinburgh with his Queen and Court in May, 1903, and there holding a Levee at Holyrood."

Some 16 or 18 years ago I requested Messrs. Yeates & Son to make me two instruments—a weathercock (the history of which may be interesting) and an anemometer. These I placed on two long larch poles about 40 ft. high, 6 ft. apart, and for convenience coupled them together near the top by three bars, on which the men stood to erect the instruments and otherwise attend to them. Both these instruments are connected to dials on my business-room mantelpiece. The "Robinson" cups have a dial so arranged that when the electricity is at any time switched on, the velocity of the wind at the time is indicated on the dial, while the time is taken with the chronograph which is habitually carried by me.

It was in 1877 that I found myself as Assistant Adjutant and Assistant Quartermaster-General for Scotland quartered in Edinburgh, where, near the convent at Warrender Place, I bought a small house. All my life I have been taking notes in some way or another of rain and wind, and so forecasting for my own convenience by the aid of barometer, thermometer, &c., the probable weather. When I bought my new house it occurred to me I would like a weathercock (or vane) on the top, with a dial inside the house, and the first thing I thought of was a powerful vane turning a spindle going right down through the roof and turning the arrow on the dial by means of bevel wheels. But on second thoughts it seemed to me noisy and clumsy, so I worked out in my mind a weathercock so arranged with contact parts that by means of four electric wires the four points of the compass would be brought up on the dial.

Nowhere, however, could I find such a thing either in London or Edinburgh. At last the great Electric Exhibition took place in Paris, and the following year at Sydenham. Being by this time quartered at Kingston-on-Thames, in command of the South London Brigade, I hied me on my bike to the Crystal Palace one day with my sketches and specifications in my pocket, and at every likely stall made enquiry for what I was in search of; but as in Edinburgh and London, so there, no such thing I was assured had ever been heard of. Perhaps a year or so afterwards, at a show of some sort in the Agricultural Hall, I found an instrument approaching what I required, but not sufficiently perfect to be of any good, and the first successful one that ever came to my notice was erected in the entrance hall of the Constitutional Club. However, instead of four connections this was worked with eight points of the compass, and I rejected it because it seemed too complicated; and that it afterwards proved itself to be, for it soon got out of order, and though it has been repaired more than once, it is seldom or never

working properly. Ultimately I found just what I required depicted in one of Messrs. Yeates & Sons' illustrated catalogues. There are four letters, N., E., S. and W., and when a button is pressed up flies one or two of these letters ; if two fly up at a time, such as N. and W., that indicates north-west. So altogether I have eight points of the compass for my four wires and one return.

There is an ordinary weathercock with the four letters at the end of rods on the top of the flagstaff, which is now no longer used for flying a flag, and a little bit below the top is a pair of crosstrees on which the two before-named instruments are fixed, and it is arranged hereafter to erect two more wind instruments at the same level on crosstrees at right angles to those now up.

In addition to the above-named instruments I have on my mantel-piece a recording rain gauge which registers every hundredth ( $\cdot 01$ ) of an inch of water that falls, so that at any minute on a dark winter's night it is easy to see what is going on outside, and this instrument has the further advantage that each time it records  $\cdot 01$  in. it gives a loud "click," so that when I am sitting reading I not only am made aware that it is raining more or less heavily, but by paying attention for a short time can tell how fast it is raining without leaving my chair.

I trust that this letter will be of some interest to your readers.

J. SPROT (Lt.-General).

*Riddell, Lilliesleaf.*

## THE CLOSING OF THE BEN NEVIS OBSERVATORIES.

AS we intimated last month, the meteorological observatories on the summit of Ben Nevis, 4,400 feet above sea level, and at Fort William, practically at the level of the sea, were closed on October 1st, 1904. We look upon this as a misfortune, and can only avoid the old and unsatisfactory explanation that someone has blundered, by adopting the older and less satisfactory explanation that several people have blundered. The blunder has been made, and it has been intensified by some well-meaning, but ill-advised, writers and newspapers trying to make the cessation of the observatories a Scottish grievance. The Directors of Ben Nevis Observatory very properly repudiate any such suggestion. It was a splendid and public-spirited act on the part of the Scottish people to render so substantial and considerable a service to science as the founding and support of a high level observatory at the highest possible level ; but the fact that they did so does not make the observations of more value to Scotland than to England ; indeed, it would seem that they were of most value to Germany, for the German Weather Bureau alone appears to have utilised the daily results. We look upon the loss as a loss to science, and if any one set of conditions can be blamed for it we must blame the narrow views of the public of every section of the country, of Parliament and of the Govern-

ment in looking at scientific research in a local or a merely utilitarian light.

The harm has been done in the present instance: the records are broken beyond the power of "all the king's horses and all the king's men" to put together again, and there is time enough to think of starting afresh when we know how the recommendations of the Treasury Committee as to the Meteorological Office are to be treated by the Government. Meanwhile, we publish a full abstract of the last complete year's work of the abandoned observatories.

*Report of the Committee of the British Association, consisting of LORD McLAREN, PROFESSOR A. CRUM BROWN (Secretary), SIR JOHN MURRAY, DR. ALEXANDER BUCHAN, and MR. R. T. OMOND. (Drawn up by DR. BUCHAN.)*

The results of the observations made at the two Observatories during 1903 are detailed in the following Table.

| 1903 | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | YEAR |
|------|------|------|------|------|------|-------|-------|------|-------|------|------|------|------|
|------|------|------|------|------|------|-------|-------|------|-------|------|------|------|------|

*Mean Pressure in inches.*

|                |        |        |        |        |        |        |        |        |        |        |        |        |        |
|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Ben Nevis Obs. | 25.099 | 25.148 | 24.915 | 25.232 | 25.325 | 25.555 | 25.360 | 25.189 | 25.405 | 24.925 | 25.315 | 25.056 | 25.210 |
| Fort William.. | 29.720 | 29.726 | 29.475 | 29.845 | 29.363 | 30.088 | 29.847 | 29.659 | 29.924 | 29.410 | 29.915 | 29.650 | 29.760 |
| Differences..  | 4.621  | 4.578  | 4.560  | 4.613  | 4.538  | 4.533  | 4.487  | 4.470  | 4.519  | 4.485  | 4.600  | 4.594  | 4.550  |

*Mean Temperatures.*

|                |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Ben Nevis Obs. | 22.7 | 27.3 | 24.6 | 24.5 | 33.4 | 38.7 | 39.3 | 37.6 | 37.3 | 31.7 | 28.3 | 24.2 | 30.8 |
| Fort William.. | 38.5 | 43.2 | 41.5 | 42.7 | 49.7 | 55.9 | 55.1 | 53.9 | 53.6 | 47.8 | 43.5 | 38.5 | 46.8 |
| Differences..  | 15.8 | 15.9 | 16.9 | 18.2 | 16.3 | 15.2 | 15.3 | 16.3 | 16.3 | 16.1 | 15.2 | 14.3 | 16.0 |

*Extremes of Temperature: Maxima.*

|                |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Ben Nevis Obs. | 35.7 | 42.3 | 37.0 | 35.0 | 56.0 | 58.0 | 49.6 | 49.0 | 50.0 | 40.5 | 41.9 | 36.6 | 58.0 |
| Fort William.. | 50.4 | 55.6 | 56.5 | 57.6 | 71.5 | 76.0 | 71.1 | 63.8 | 68.0 | 60.0 | 55.5 | 54.0 | 76.0 |
| Differences..  | 14.7 | 13.3 | 19.5 | 22.6 | 15.5 | 18.0 | 21.5 | 14.8 | 18.0 | 19.5 | 13.6 | 17.4 | 18.0 |

*Extremes of Temperature: Minima.*

|                |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Ben Nevis Obs. | 7.7  | 17.0 | 14.9 | 12.6 | 15.7 | 22.8 | 27.7 | 31.0 | 24.3 | 22.8 | 10.9 | 13.3 | 7.7  |
| Fort William.. | 21.3 | 32.1 | 32.3 | 29.6 | 33.4 | 36.2 | 40.6 | 42.2 | 35.8 | 31.0 | 23.5 | 22.4 | 21.3 |
| Differences..  | 13.6 | 15.1 | 17.4 | 17.0 | 17.7 | 13.4 | 12.9 | 11.2 | 11.5 | 8.2  | 12.6 | 9.1  | 13.6 |

*Rainfall in inches.*

|                |       |       |       |      |      |      |       |       |       |       |       |      |        |
|----------------|-------|-------|-------|------|------|------|-------|-------|-------|-------|-------|------|--------|
| Ben Nevis Obs. | 33.45 | 36.24 | 37.95 | 8.36 | 6.61 | 6.44 | 13.26 | 20.97 | 10.72 | 18.66 | 17.27 | 6.81 | 216.74 |
| Fort William.. | 16.12 | 17.04 | 17.25 | 3.81 | 4.49 | 2.97 | 6.60  | 11.95 | 7.15  | 13.05 | 7.85  | 5.61 | 113.89 |
| Differences..  | 17.33 | 19.20 | 20.70 | 4.55 | 2.12 | 3.47 | 6.66  | 9.02  | 3.57  | 5.61  | 9.42  | 1.20 | 102.85 |

*Number of Days 1 in. or more fell.*

|                |    |    |    |   |   |   |   |   |   |   |   |   |    |
|----------------|----|----|----|---|---|---|---|---|---|---|---|---|----|
| Ben Nevis Obs. | 11 | 13 | 17 | 4 | 1 | 2 | 5 | 3 | 3 | 8 | 5 | 3 | 79 |
| Fort William.. | 5  | 7  | 7  | 0 | 1 | 0 | 1 | 7 | 1 | 4 | 1 | 2 | 32 |
| Differences..  | 6  | 6  | 10 | 4 | 0 | 2 | 4 | 4 | 2 | 4 | 4 | 1 | 47 |

*Number of Days .01 in. or more fell.*

|                |    |    |    |    |    |    |    |    |    |    |    |    |     |
|----------------|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Ben Nevis Obs. | 22 | 27 | 28 | 22 | 19 | 18 | 23 | 29 | 18 | 29 | 22 | 23 | 280 |
| Fort William.. | 21 | 26 | 31 | 13 | 16 | 12 | 21 | 27 | 21 | 29 | 22 | 20 | 259 |
| Differences..  | 1  | 1  | -3 | 9  | 3  | 6  | 2  | 2  | -3 | 0  | 0  | 3  | 21  |

*Mean Rainband (Scale 0—8).*

|                |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ben Nevis Obs. | 1.4 | 2.4 | 2.0 | 2.0 | 2.3 | 3.6 | 2.7 | 2.6 | 2.5 | 3.3 | 2.5 | 1.5 | 2.4 |
| Fort William.. | 3.6 | 4.8 | 3.9 | 3.1 | 3.8 | 4.7 | 4.7 | 4.7 | 4.0 | 4.5 | 4.0 | 3.4 | 4.1 |
| Differences..  | 2.2 | 2.4 | 1.9 | 1.1 | 1.5 | 1.1 | 2.0 | 2.1 | 1.5 | 1.2 | 1.5 | 1.9 | 1.7 |

| 1903. | Jan. | Feb. | Mar. | Apr. | May. | Jun. | July | Aug. | Sept. | Oct. | Nov. | Dec. | YEAR |
|-------|------|------|------|------|------|------|------|------|-------|------|------|------|------|
|-------|------|------|------|------|------|------|------|------|-------|------|------|------|------|

*Number of Hours of Bright Sunshine.*

|                |    |    |    |     |     |     |     |    |     |    |    |    |     |
|----------------|----|----|----|-----|-----|-----|-----|----|-----|----|----|----|-----|
| Ben Nevis Obs. | 16 | 5  | 11 | 40  | 79  | 137 | 76  | 23 | 67  | 16 | 21 | 18 | 509 |
| Fort William.. | 22 | 10 | 39 | 120 | 135 | 178 | 141 | 91 | 126 | 26 | 21 | 15 | 934 |
| Differences..  | 6  | 5  | 28 | 80  | 56  | 41  | 65  | 68 | 59  | 20 | 0  | +3 | 425 |

*Mean Hourly Velocity of Wind in Miles.*

|                                |    |    |    |    |    |   |    |    |    |    |   |    |    |
|--------------------------------|----|----|----|----|----|---|----|----|----|----|---|----|----|
| Ben Nevis Ob-<br>servatory ... | 22 | 17 | 17 | 11 | 11 | 9 | 11 | 12 | 20 | 18 | 9 | 19 | 15 |
|--------------------------------|----|----|----|----|----|---|----|----|----|----|---|----|----|

*Percentage of Cloud.*

|                |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----------------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Ben Nevis Obs. | 88 | 98 | 95 | 80 | 82 | 74 | 86 | 95 | 80 | 96 | 89 | 83 | 87 |
| Fort William.. | 73 | 88 | 85 | 74 | 73 | 68 | 75 | 83 | 66 | 89 | 80 | 77 | 78 |
| Differences..  | 15 | 10 | 10 | 6  | 9  | 6  | 11 | 12 | 14 | 7  | 9  | 6  | 9  |

At Fort William the mean atmospheric pressure was 29·760 in., or ·098 in. below the average of thirteen years; whilst the mean at the top was 25·210 in., or ·090 in. below the average of twenty years. The mean difference for the two Observatories was 4·550 in., the mean monthly difference varying from 4·621 in. in January to 4·470 in. in August. At both places the mean for the year was considerably lower than any hitherto recorded, and only in June, September and November were the monthly means above their normals. The means for October were much lower than any yet recorded for that month, the deficiency at Fort William being as much as ·365 in. At the top the absolutely highest pressure for the year was 25·941 in. at 2 p.m. on May 26th, and the lowest 23·916 in. at 5 a.m. on February 27th. At Fort William the extremes were 30·572 in. at 10 a.m. on November 6th, and 28·326 in. at 6 a.m. on February 27th. The extreme range on Ben Nevis was, therefore, 2·025 in., and at Fort William 2·246 in.

The most remarkable features of the year as regards temperature were the low temperatures for April and the cold weather of the summer months. At both Observatories the April mean temperatures were the lowest recorded for that month since 1891, the shade minimum at Fort William registering frost from 12th to 18th, and on 22nd and 24th; whilst on Ben Nevis the minimum fell to 12°·6 on 17th, and the maximum rose above the freezing point on only 11 days of the month, the highest shade reading there being no higher than 35°·0, on the 6th and 9th. The absolutely highest temperature for the year at Fort William was 76°·0 on June 7th, and at the top 58°·0 on the same day; the lowest at Fort William being 21°·3 on January 13th, and at the top 7°·7 on January 10th.

In the next table are given the lowest observed hygrometric readings at the top of Ben Nevis (reduced by means of Glaisher's Tables):—

| 1903                | Jan.  | Feb. | Mar.  | Apr. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec.  |
|---------------------|-------|------|-------|------|------|-------|-------|------|-------|------|------|-------|
| Dry Bulb .....      | 19·1  | 42·2 | 22·6  | 16·1 | 42·0 | 47·3  | 39·8  | 42·7 | 40·6  | 31·0 | 23·0 | 21·0  |
| Wet Bulb .....      | 15·3  | 32·0 | 18·1  | 14·1 | 32·0 | 33·5  | 30·9  | 32·8 | 30·3  | 25·6 | 19·0 | 15·7  |
| Dew-point.....      | -12·4 | 20·2 | -10·7 | -1·3 | 20·0 | 18·3  | 19·3  | 20·9 | 16·9  | 11·0 | -6·2 | -20·9 |
| Elastic Force ..... | ·024  | ·109 | ·025  | ·041 | ·108 | ·099  | ·104  | ·112 | ·093  | ·071 | ·032 | ·016  |
| Relative Humidity   | 23    | 41   | 21    | 46   | 40   | 30    | 42    | 41   | 37    | 41   | 26   | 14    |
| Day of Month.....   | 8     | 9    | 3     | 18   | 29   | 5     | 8     | 1    | 16    | 18   | 18   | 29    |

Of these relative humidities, the lowest, 14 per cent., occurred on December 29th with a dew-point of  $-20^{\circ}9$ , that being the lowest dew-point for the year. From 9 a.m. on January 21st to noon on February 9th—that is for a period of 507 hours—the atmosphere was continuously in a saturated condition, the summit of the mountain being wreathed in fog or mist throughout the period, except for one short break of three hours. The next longest periods of continuous saturation were from April 3rd to 11th, from September 3rd to 10th, and from December 9th to 17th.

The rainfall for the year at the top was 216.74 in., or 55.97 in. above the average of 19 years; whilst the annual amount at Fort William was 113.89 in., or 35.31 in. above the average for the same period. At Fort William the year was the wettest hitherto recorded, but on Ben Nevis the amount was considerably below that for 1898, when the total was as much as 240.12 in. On Ben Nevis the totals for January, February, March and August were the largest hitherto recorded for these months, whilst the aggregate for the first three months was half the total for the year and considerably more than twice the average. At Fort William, also, about half the annual amount was registered during the first three months, whilst the aggregate for that period was more than twice the average. At the top of the mountain the greatest fall recorded on a single day was 4.78 in. on January 29th, the corresponding fall at Fort William being 1.78 in.; whilst the maximum daily amount at Fort William was 3.09 in. on January 25th, the fall at the top on that day being 3.03 in.

At the top of Ben Nevis the number of rainy days was 280, or 17 above the average, and at Fort William 259 days, or 25 above the average. The number of days on which 1 inch or more fell was much above the average at both observatories, Ben Nevis having no fewer than 79 such days, or 26 above the average, and Fort William 32, or 17 above the average. Of these days of heavy falls, as many as 41 occurred at Ben Nevis during the first three months of the year, and as many as 19 at Fort William. Considering also daily falls of between .50 in. and .99 in., and less heavy falls, we have the following table:—

| Daily Falls of        | Aggregate of Falls. |               | Number of Days. |               |
|-----------------------|---------------------|---------------|-----------------|---------------|
|                       | Ben NevisObs        | Fort William. | Ben NevisObs    | Fort William. |
| 1 in. and over .....  | 149.4 in.           | 51.3 in.      | 79              | 32            |
| 50 in. to .99 in..... | 39.0 ,,             | 32.1 ,,       | 52              | 46            |
| Less than 50 in. .... | 28.3 ,,             | 30.5 ,,       | 149             | 181           |
| Total ... ..          | 216.7 ,,            | 113.9 ,,      | 280             | 259           |

Thus, on Ben Nevis nearly half, and at Fort William nearly one-third, of the number of rainy days had falls of .50 in. or over, whilst at the top of the mountain such falls contributed six-sevenths of the total for the year. Again, at Fort William 45 per cent. of the annual amount, and at the high-level station nearly 70 per cent. was due to daily falls of 1 inch or over.

The sunshine recorder on Ben Nevis registered 509 hours out of a total

possible of 4,473 hours, or 11·4 per cent. of the possible sunshine, being 227 hours below the average of twenty years. This is the smallest annual amount recorded since the Observatory was opened, the next least sunny years being 1884 with 524 hours, 1886 with 571, and 1890 with 591. The amounts for February and March were the least on record for these months, and only in June, September and December were the totals above the average, and that by very small amounts. At Fort William the annual amount was 934 hours, being the smallest total in thirteen years and 185 hours below the average for that period. February, March and October had the smallest amounts on record for these months, the total of 10 hours in February being only one-fifth of the average for that month.

On Ben Nevis the mean percentage of cloud was 87, and at Fort William 78, both above the average. February, March, August and October were very cloudy months, the eye estimations of cloud amount agreeing with the small amount of sunshine registered by the sunshine recorder.

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### DR. W. N. SHAW ON THE GENERAL CIRCULATION OF THE ATMOSPHERE.

DR. W. N. SHAW makes a valuable contribution to the existing knowledge of atmospheric circulation in a paper read before the Royal Society during June of the present year.\* His results are derived from observations made during an investigation of the trajectories of air by means of synoptic charts, and show that the paths of air taking part in cyclonic disturbances do not always originate, as is commonly supposed, in anti-cyclonic areas, but follow a track skirting high pressure areas and traversing sometimes a very large part of a belt of the Earth in a direction more or less parallel to a line of latitude, and that the general motion of the air in middle latitudes is more or less of the nature of a passage round the poles in an easterly direction. These suggestions are confirmed by the indications of the wind charts of the South Atlantic prepared by the Meteorological Council and also by the observations of cloud movements of Hildebrandsson.

Charts have been drawn upon Mercator's projection, showing for the month of January (1) the mean surface isobars; (2) the mean isobars at an altitude of 4,000 metres, as computed by M. Teisserenc de Bort from the mean surface temperatures; (3) the isobars indicating the pressure due to the weight of the atmosphere below 4,000 metres, arrived at by deducting the pressure above 4,000 metres from that at the surface; and (4) the mean temperature at the Earth's surface. In the chart showing the pressure of the upper stratum alone the effect of cyclonic distribution is, as might be expected, practically obliterated, so that no isolated low pressure areas remain and the general trend of the isobars is in a direction

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\* On the general circulation of the atmosphere in middle and higher latitudes, by W. N. Shaw, F.R.S. *Proc. R.S.* 74 (1904), 20-30.

parallel to lines of latitude, forming complete circum-polar rings. It is shown that the air movement at high altitudes is practically parallel to the isobars, any divergences being too slight to affect the considerations put forward.

The third chart, showing the distribution of pressure of the stratum of air below 4,000 metres, gives a very remarkable result. The general trend of the lines is similar to that for the upper air, but the direction of the gradient is in every case reversed. The only noticeable point of difference in the direction of the isobars in the two charts is that in the chart for the upper stratum alone the circulation is indicated as taking place round the geographical poles, whilst in the lower stratum it seems to take place round the poles of greatest cold. This distinction is only apparent in the northern hemisphere, where the pole of greatest cold is in northern Siberia, whilst in the southern hemisphere the two poles may be assumed to coincide.

The forces represented by the average pressure distribution for January may thus be separated into that due to the stratum above 4,000 metres, which would correspond to a steady air movement from west to east, and that due to the stratum below 4,000 metres, which would produce a steady motion in the opposite direction. The superposition of the two systems gives a line of minimum pressure with a westerly flow of air on the equatorial side and an easterly flow on the polar side. This line of minimum average pressure forms the track of circular storms on the surface of the Earth. The difference of the density of air at different temperatures, together with the instability due to the condensation of water vapour, would disturb any equilibrium which could be established, and the region of minimum pressure then becomes the scene of cyclonic movements and variable winds.

Since the distribution of pressure in the lower stratum is directly dependent upon surface temperature, whereas the influence of this factor upon the pressure of the upper stratum is naturally much less marked, the effect of changes in surface temperature may be considered as changing the character of the lower stratum and leaving that of the upper stratum practically unaltered. The former are easily calculable, and we are thus in a position to apply known factors to the combination of the two systems, which forms the actual pressure at the Earth's surface. This, as the author points out, may have very important consequences with relation to classifying the facts within our knowledge of weather changes in middle latitudes.

Another conclusion pointed out is the confirmation of Sir John Murray's suggestion of the existence of a high pressure area over the Antarctic continent, since the effect of the lower component would become intensified by the extreme cold immediately surrounding the South Pole.

It is pointed out that the division of the atmosphere into upper

and lower strata at an altitude of 4,000 metres is purely arbitrary, and that it was selected because the data were already worked out by M. Teisserenc de Bort, although it is an altitude in the region of clouds of an intermediate height, and probably does not correspond to any specific discontinuity of the atmospheric layer. The isobars are not susceptible of very great accuracy at high levels, and even at the surface are not entirely to be relied upon over the oceanic areas.

The author holds out the hope of showing in a future paper that storms in the region of minimum pressure in temperate latitudes may arise from special surface conditions, and that there is at least some evidence for the correlative origin of tropical hurricanes.

The results given in the paper were confined wholly to the distribution during the month of January, but an investigation from incomplete data for July showed results in many respects similar.



### ROYAL METEOROLOGICAL SOCIETY.

At the opening meeting of the session, on November 16th, Captain D. Wilson-Barker, President, in the chair, Lieutenant Charles Royds, R.N., of the *Discovery*, gave a most interesting address on "Meteorological Observing in the Antarctic," which he illustrated with numerous lantern slides. Lieut. Royds was the officer specially charged with the meteorological observations during the recent National Antarctic Expedition.

The ship arrived at her winter quarters on February 8th, 1902, and as soon as the water in the bay was frozen, the meteorological instruments were set up on the ice. This became to all intents and purposes a land station in latitude  $77^{\circ} 50' S.$ , and observations were carried on there from April 17th, 1902, until February 15th, 1904, when the ice broke up and allowed the ship to go free.

The observations were taken every two hours, those from 8 a.m. to 10 p.m. being taken by Lieut. Royds, and the night observations being divided between the eleven officers and members of the scientific staff, each one taking a night.

The highest temperatures recorded in each year were  $39^{\circ}$  on December 26th, 1902, and  $42^{\circ}$  also on December 26th, 1903. The lowest temperature registered during the stay in winter quarters was  $-59^{\circ}.5$ , on August 20th, 1903, while at Cape Armitage, a mile and a half to the south of the ship, the minimum on the same day was  $-64^{\circ}.6$ . The lowest temperature registered at Cape Armitage, however, was  $-67^{\circ}.7$ , at noon on July 19th, 1902.

The heaviest gale was on July 19th, 1902, when for ten hours the anemometer gave a velocity of 85 miles per hour. Blizzards were frequent and added considerably to the difficulties of observing, as the drifting snow choked up the instruments and the screens, and also stopped the self-recording instruments. A peculiarity of the

blizzards was the invariable rise of temperature ; and they always came from the south and south-west.

It has sometimes been supposed that the sun seldom showed itself in the Antarctic regions. Lieut. Royds, however, said that this was utterly wrong, as day after day there were most glorious clear skies and continuous sunshine. In proof of this he showed a lantern slide of three cards from the Campbell-Stokes recorder which had traces of 24 hours' continuous sunshine.\* The effect of the sun on the explorers' faces was very marked. During the winter, from living in artificial light, their faces turned yellow and various other colours. but when they went away sledging and were out in the sunshine for nine or ten hours every day, their faces turned absolutely brown and their lips cracked, while the skin blistered, and in many cases the face became swollen.

Lieut. Royds said that he had never seen such beautiful and striking examples of every sort of cloud as south of the Antarctic circle. Mirage was common, and so were halos and coronæ—some of which were very beautiful and complicated. Auroræ were not uncommon, but they were not so highly coloured nor so brilliant as those seen in the Arctic regions.

Mr. F. J. Brodie read a paper on the "Decrease of Fog in London during recent years." He had tabulated the number of days of fog reported at Brixton, the London station of the Meteorological Office, for the 33 years 1871—1903, and found that the mean annual number of fog days was 55, of which 45 occurred in the winter half of the year and only 10 in the summer half. December was the foggiest month with 9·5, the next being November with 8·5, January with 8·2, and October with 7·8. The clearest months were July with 0·4, June with 0·6, and May with 0·8. The greatest number of fog days were 86 in 1886, and 83 in 1887 ; and the least 13 in 1900, and 26 in 1903. Dividing the 33 years into three periods of 11 years each, the author showed that the mean for 1871—1881 was 55, for 1882—1892 it was 69, while for 1893—1903 it was only 41 ; there being thus a very marked decrease in the number of days with fog during the last 11 years.

The discussion on Mr. Brodie's paper was postponed till the next meeting, on December 21st.

During the evening the following gentlemen were elected Fellows of the Society :—Mr. G. W. Chilvers ; Mr. G. M. Clark, M.A. ; Rev. J. N. Cushing, D.D. ; Mr. C. Dales ; Mr. W. B. A. Dingwall ; Mr. J. H. Field, B.A., B.Sc. ; Mr. C. B. Goodyer ; Mr. J. S. Hill, B.A., B.Sc. ; Mr. E. Lewys Lloyd, M.R.C.S ; Mr. T. Midgley ; Mr. G. F. Nightingale ; Mr. G. Paul ; Mr. R. W. Smith, Jun. ; and Mr. C. H. Timmler.

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\* It may be mentioned that one of the officers of the *Terror*, which visited the Antarctic seas in 1840-43, was so impressed with the exquisite clearness of the fine days in the far South that he strongly advocated the selection of Victoria Land as the site of a station for observing the Transits of Venus.—*Ed. S. M. M.*

## REVIEWS.

*The Survey Atlas of England and Wales. Designed by and prepared under the direction of J. G. BARTHOLOMEW, F.R.S.E., F.R.G.S. Drawn, Engraved, Printed and Published by the Edinburgh Geographical Institute under the patronage of the Royal Geographical Society. 1903 [1904]. Size 18 × 12½. Price £3 10s.*

GEOGRAPHY is so essential to the comprehension of climatology and is so intimately concerned in the relations of air, sea and land, that even although the Atlas before us contained no section dealing directly with climate we should still consider it an appropriate subject for a review in these pages. The Atlas consists of eighty-four plates of maps and plans with descriptive text. The earlier maps deal with England and Wales as a whole, and they present some features of remarkable interest. First comes a map showing by appropriate colouring the general build of the country, expressing the contrast between highland, hill and plain in a very effective way. It was found that while there was no feature of the surface of England too small to have a name of its own, some of the features which are prominent in this map were too large to have any one name throughout their whole extent, though their unity made it desirable that they should have one; accordingly some names had to be devised or adapted, and this was done with the approval of the Royal Geographical Society. Maps of monthly temperature and rainfall show the general seasonal changes in a satisfactory way, and could scarcely be improved upon on so small a scale as is necessarily adopted. Other striking general maps deal with geology, mineral productions, and, above all, population. The population map shows at a glance those parts of the country where people are most closely congregated, and those which are thinly inhabited or entirely unpeopled. The other maps of surface relief, mineral wealth and climate explain the reasons for the grouping of people in many cases. The chief utility of the Atlas, and this we have tested during the time when it was coming out in parts, lies in the great map of England in 67 plates on the scale of half-an-inch to a mile. Its unique feature is the system of colouring in soft and agreeable shades of green and brown to indicate the approximate height above sea level. Once this system is mastered its advantages will be too apparent to allow anyone to care for an uncontoured map again, and the system is carried out as faithfully in the little pocket "Touring Atlas of the British Isles," sold for a shilling or less, as in this great volume. The completion of this large map of England has greatly facilitated the work of identifying the sites of the rain gauges which each year sees added to the pages of *British Rainfall*, and for this we are more grateful than our readers can perhaps realise. The fine workmanship and accurate cartography of Mr. Bartholomew's publications were fitly acknowledged by the award of the *Grand Prix*—the highest distinction given—at the Universal Exposition at St. Louis.

*Hourly Readings obtained from the Self-recording Instruments at four Observatories under the Meteorological Council, 1900. Thirty-second Year. New Series, Vol. I.* London: Published for His Majesty's Stationery Office, 1904. Size 12 × 10. Pp. xiv. + 196. Price 25s.

THIS new series contains welcome improvements in the arrangement of the tables, greatly enhancing their utility, and more is promised. When the arrears have been overtaken it is intended to prepare the hourly readings for the press as soon as possible after the close of each month, and the sheets in the present issue are accordingly paged so that the observations for the month at the four Observatories (Valencia, Aberdeen, Falmouth and Kew) come together, but the results for the several Observatories can be grouped and bound separately if desired. The monthly observations for each Observatory are even marked "Price Sixpence," and we would suggest that while the arrears are being wiped off the separate publications of the months of 1905 be commenced up to date. When observations are already four years old we can make up our minds to wait a fifth year if by so doing the current year's record can be obtained with a minimum retardation. We should like to see a table of the hourly duration of rainfall, similar to that of sunshine, given as a supplement to the table of hourly amount of rainfall which only tells half the story; though we are happy to find that it now tells that half in an easy, straightforward manner, for it has escaped from the valley of the shadow of averages.

### METEOROLOGICAL NEWS AND NOTES.

A METEOROLOGICAL STATION IN ST. JAMES'S PARK has recently been established by the Meteorological Council, near the Horse Guards Parade. It is equipped with a Halliwell self-recording rain gauge in addition to the ordinary instruments. Notice boards are also provided for the display of the records and the weather charts.

THE UTILITY OF RAINFALL OBSERVATIONS is not often so amusingly demonstrated as in the following extract from the *Daily Mail* of November 30th. One would think that with so much at stake both parties to such a contract would have been at the trouble to employ a proper instrument.

DISPUTE ABOUT A RAINFALL.—The question of rainfall at Paignton last Whit-Monday was the cause of a dispute which was decided at Totnes County Court yesterday, when the committee which arranged the Paignton gala and sports sued an insurance company for £36 15s. They effected an insurance with Lloyd's, the undertaking being that if more than .08 in. of rain fell between nine in the morning and four o'clock in the afternoon they would receive the difference between the gate receipts and £100. The plaintiffs, who took the gauge with a pencil and an ordinary rule, measured an eighth of an inch. The defendants doubted the possibility of such a heavy fall, as at Torquay, two miles away, only a hundredth of an inch was recorded. The jury gave a verdict for the plaintiffs, and the judge said that although the committee had adopted antiquated methods, the defendants made no effort to take the gauge themselves.

RAINFALL AND TEMPERATURE, NOVEMBER, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.      |                                   |                          |       |      | Days on which<br>1/10 or more fell. | TEMPERATURE. |      |        |       | No. of<br>Nights<br>below<br>32°. |  |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------|--------------------------|-------|------|-------------------------------------|--------------|------|--------|-------|-----------------------------------|--|
|        |                                                                                                                                      | Total<br>Fall. | Diff. from<br>average,<br>1890-9. | Greatest in<br>24 hours. |       | Max. |                                     | Min.         |      |        |       |                                   |  |
|        |                                                                                                                                      |                |                                   | Depth                    | Date. | Deg. |                                     | Date.        | Deg. | Date.  | Shade | Gross                             |  |
| I.     | London (Camden Square) ...                                                                                                           | 1.70           | — .52                             | .39                      | 10    | 11   | 58.8                                | 9            | 24.1 | 26     | 9     | 18                                |  |
| II.    | Tenterden .....                                                                                                                      | 2.04           | — .53                             | .95                      | 10    | 11   | 59.0                                | 11           | 25.0 | 26     | 10    | 14                                |  |
|        | Hartley Wintney .....                                                                                                                | 1.42           | — 1.06                            | .43                      | 10    | 8    | 58.0                                | 9            | 18.0 | 26, 27 | 14    | 16                                |  |
| III.   | Hitchin .....                                                                                                                        | 1.36           | — 1.06                            | .30                      | 7     | 12   | 58.0                                | 9            | 16.0 | 23     | 13    | ...                               |  |
|        | Winslow (Addington) .....                                                                                                            | 1.50           | — .97                             | .34                      | 10    | 10   | 60.0                                | 3            | 6.0  | 24     | 14    | 18                                |  |
| IV.    | Bury St. Edmunds (Westley) .....                                                                                                     | 1.50           | — 1.00                            | .37                      | 23    | 12   | 59.5                                | 3            | 17.0 | 24     | ...   | ...                               |  |
|        | Brundall .....                                                                                                                       | 2.00           | — .46                             | .52                      | 26    | 15   | 59.0                                | 9            | 23.0 | 24     | 12    | 17                                |  |
| V.     | Alderbury .....                                                                                                                      | 2.57           | — 2.45                            | .29                      | 10    | 6    | 60.0                                | 6            | 17.0 | 27     | 12    | ...                               |  |
|        | Winterborne Steepleton .....                                                                                                         | 1.80           | ...                               | .72                      | 7     | 12   | 58.3                                | 12           | 21.9 | 27     | 11    | 19                                |  |
|        | Torquay (Cary Green) .....                                                                                                           | 1.55           | ...                               | .48                      | 7     | 10   | 59.8                                | 6            | 28.0 | 25     | 5     | 11                                |  |
|        | Polapit Tamar [Launceston] .....                                                                                                     | 4.52           | + .64                             | .88                      | 10    | 19   | 58.8                                | 14           | 6.9  | 25     | 13    | 15                                |  |
|        | Bath .....                                                                                                                           | 1.81           | ...                               | .48                      | 7     | 8    | 58.2                                | 9            | 21.0 | 24, 25 | 12    | 20                                |  |
| VI.    | Stroud (Upfield) .....                                                                                                               | 1.52           | — 1.17                            | .40                      | 10    | 9    | 55.0                                | 3            | 21.0 | 26     | 9     | ...                               |  |
|        | Church Stretton (Woolstaston) .....                                                                                                  | 1.20           | — 1.58                            | .30                      | 21    | 11   | 56.5                                | 9            | 24.5 | 23     | 8     | ...                               |  |
|        | Bromsgrove (Stoke Reformatory) .....                                                                                                 | .99            | — .99                             | .28                      | 6     | 6    | 55.0                                | 3, 9         | 6.0  | 23, 24 | 17    | ...                               |  |
| VII.   | Boston .....                                                                                                                         | .57            | — 1.28                            | .20                      | 22    | 6    | 60.0                                | 2            | 12.0 | 24     | 15    | ...                               |  |
|        | Bawtry (Hesley Hall) .....                                                                                                           | .80            | — 1.14                            | .26                      | 21    | 14   | 61.0                                | 9            | 16.0 | 25     | 15    | ...                               |  |
|        | Derby (Midland Railway) .....                                                                                                        | 1.25           | — .68                             | .27                      | 10    | 17   | 56.0                                | 9            | 13.0 | 23     | 12    | ...                               |  |
| VIII.  | Bolton (The Park) .....                                                                                                              | 3.72           | + .21                             | .85                      | 8     | 16   | 54.6                                | 9            | 21.5 | 24     | ...   | ...                               |  |
| IX.    | Wetherby (Ribston Hall) .....                                                                                                        | 2.25           | + .29                             | .84                      | 7     | 15   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
|        | Arncliffe Vicarage .....                                                                                                             | 7.04           | + .97                             | 3.10                     | 8     | 17   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
|        | Hull (Pearson Park) .....                                                                                                            | 1.51           | — .78                             | .38                      | 7     | 18   | 59.0                                | 3, 5, 9      | 24.0 | 24     | 8     | 21                                |  |
| X.     | Newcastle (Town Moor) .....                                                                                                          | 3.14           | + .68                             | .78                      | 21    | 14   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
|        | Borrowdale (Seathwaite) .....                                                                                                        | 12.52          | — 1.46                            | 3.98                     | 8     | 18   | 55.8                                | 8            | 19.4 | 26     | 8     | ...                               |  |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 3.49           | — .47                             | .84                      | 6, 10 | 19   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
|        | Haverfordwest (High St.) .....                                                                                                       | 3.51           | — 1.35                            | .78                      | 10    | 17   | 57.2                                | 9            | 21.2 | 27     | 7     | 18                                |  |
|        | Aberystwith (Gogerddan) .....                                                                                                        | 3.18           | — 1.77                            | .60                      | 11    | 9    | 65.0                                | 3            | 18.0 | 23, 26 | 12    | ...                               |  |
|        | Llandudno .....                                                                                                                      | 1.84           | — 1.50                            | .40                      | 27    | 15   | 57.0                                | 9, 14        | 29.5 | 27     | 3     | ...                               |  |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 3.10           | — 1.44                            | .90                      | 22    | 9    | 57.0                                | 3            | 17.0 | 26     | 13    | ...                               |  |
| XIII.  | Edinburgh (Royal Observatory) .....                                                                                                  | 1.06           | ...                               | .38                      | 9     | 13   | 56.4                                | 13           | 24.5 | 26     | 6     | 15                                |  |
| XIV.   | Colmonell .....                                                                                                                      | 5.30           | + .66                             | 1.68                     | 8     | 21   | 56.0                                | 13           | 20.0 | 21     | 9     | ...                               |  |
| XV.    | Tighnabraich .....                                                                                                                   | 5.81           | ...                               | 2.30                     | 8     | 21   | 50.0                                | 3, 4         | 22.0 | 21     | 12    | 14                                |  |
|        | Mull (Quinish) .....                                                                                                                 | 4.35           | — 1.62                            | .76                      | 8     | 26   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 1.00           | — 2.65                            | .25                      | 9     | 9    | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
|        | Dundee (Eastern Necropolis) .....                                                                                                    | .60            | — 2.21                            | .15                      | 9     | 13   | 61.5                                | 3            | 21.0 | 26     | 12    | ...                               |  |
| XVII.  | Braemar .....                                                                                                                        | 1.39           | — 2.38                            | .47                      | 23    | 16   | 55.0                                | 3            | 7.3  | 26     | 15    | ...                               |  |
|        | Aberdeen (Cranford) .....                                                                                                            | 1.41           | — 1.95                            | .67                      | 22    | 13   | 62.0                                | 3            | 15.0 | 25     | 15    | ...                               |  |
|        | Cawdor (Budgate) .....                                                                                                               | 1.67           | — 1.07                            | .30                      | 9     | 16   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
| XVIII. | Glencarron Lodge .....                                                                                                               | 9.12           | — .80                             | .96                      | 4     | 29   | 55.1                                | 13           | 15.0 | 21     | ...   | ...                               |  |
|        | Bendamph .....                                                                                                                       | 6.70           | — 2.30                            | .57                      | 29    | 29   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
| XIX.   | Dunrobin Castle .....                                                                                                                | 2.20           | — 1.09                            | .40                      | 8     | 16   | 56.5                                | 14           | 19.5 | 21     | 9     | ...                               |  |
|        | Castletown .....                                                                                                                     | 3.78           | ...                               | .35                      | 7     | 26   | 56.0                                | 17           | 21.0 | 21     | 11    | ...                               |  |
| XX.    | Killarney .....                                                                                                                      | 4.34           | — 1.47                            | .85                      | 7     | 17   | 60.5                                | 6            | 25.0 | 23, 27 | ...   | ...                               |  |
|        | Waterford (Brook Lodge) .....                                                                                                        | 2.15           | — 1.37                            | .92                      | 6     | 13   | 59.0                                | 9            | 21.0 | 27     | 10    | ...                               |  |
|        | Broadford (Hurdlestown) .....                                                                                                        | 2.51           | — .74                             | .63                      | 6     | 17   | 54.0                                | 14           | 25.0 | 21     | 9     | ...                               |  |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 1.68           | — 1.39                            | .56                      | 6     | 11   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
|        | Dublin (Fitz William Square) .....                                                                                                   | 1.08           | — 1.48                            | .36                      | 6     | 9    | 59.0                                | 9            | 27.3 | 22     | 7     | 10                                |  |
| XXII.  | Ballinasloe .....                                                                                                                    | 2.70           | — .87                             | .70                      | 6     | 19   | 61.8                                | 13           | 23.0 | 23     | 10    | ...                               |  |
|        | Clifden (Kylemore House) .....                                                                                                       | 6.22           | — 1.72                            | 1.06                     | 7     | 21   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
| XXIII. | Seaforde .....                                                                                                                       | 2.36           | — 1.34                            | .56                      | 10    | 21   | 56.0                                | 9            | 25.0 | 21     | 8     | 10                                |  |
|        | Londonderry (Creggan Res.) .....                                                                                                     | 4.73           | + .86                             | .58                      | 3     | 25   | ...                                 | ...          | ...  | ...    | ...   | ...                               |  |
|        | Omagh (Edenfel) .....                                                                                                                | 3.41           | — .30                             | .85                      | 6     | 23   | 55.0                                | 8            | 20.0 | 21     | 7     | 10                                |  |

+ Shows that the fall was above the average; that it was below it.

## SUPPLEMENTARY RAINFALL, NOVEMBER, 1904.

| Div.  | STATION.                       | Rain.<br>inches | Div.   | STATION.                      | Rain.<br>inches |
|-------|--------------------------------|-----------------|--------|-------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....    | 1·51            | XI.    | New Radnor, Ednol .....       | 2·59            |
| „     | Sheppey, Leysdown .....        | 1·10            | „      | Rhayader, Nantgwilt .....     | 4·03            |
| „     | Hailsham .....                 | 1·47            | „      | Lake Vyrnwy .....             | 3·11            |
| „     | Crowborough .....              | 1·89            | „      | Ruthin, Plás Drâw.....        | 2·17            |
| „     | Ryde, Beldornie Tower.....     | 1·18            | „      | Criccieth, Talarvor.....      | 2·76            |
| „     | Einsworth, Redlands.....       | 1·35            | „      | Anglesey, Lligwy .....        | 2·29            |
| „     | Alton, Ashdell .....           | 1·26            | „      | Douglas, Woodville .....      | 3·37            |
| „     | Newbury, Welford Park .....    | 2·11            | XII.   | Stoneykirk, Ardwell House     | 3·65            |
| III.  | Harrow Weald .....             | 1·79            | „      | Dalry, Old Garroch .....      | 6·46            |
| „     | Oxford, Magdalen College..     | 1·46            | „      | Langholm, Drove Road.....     | 3·83            |
| „     | Banbury, Bloxham.....          | 1·51            | „      | Moniaive, Maxwellton House    | 3·52            |
| „     | Pitsford, Sedgebrook .....     | 1·33            | „      | Lilliesleaf, Riddell .....    | 1·86            |
| „     | Huntingdon, Brampton.....      | 1·47            | XIII.  | N. Esk Reservoir [Penicuick]  | 2·60            |
| „     | Wisbech, Bank House .....      | ·82             | XIV.   | Maybole, Knockdon Farm..      | 3·74            |
| IV.   | Southend .....                 | ·92             | „      | Glasgow, Queen's Park .....   | 2·14            |
| „     | Colchester, Lexden.....        | 1·27            | XV.    | Inveraray, Newtown .....      | 5·42            |
| „     | Saffron Waldon, Newport...     | 1·54            | „      | Ballachulish, Ardsheal .....  | 6·23            |
| „     | Rendlesham Hall .....          | 1·01            | „      | Campbeltown, Redknowe..       | 4·82            |
| „     | Swaffham .....                 | 1·60            | „      | Islay, Eallabus .....         | 6·13            |
| „     | Blakeney .....                 | 1·67            | XVI.   | Dollar .....                  | 1·67            |
| V.    | Bishop's Cannings .....        | 1·79            | „      | Balquhider, Stronvar .....    | 2·63            |
| „     | Ashburton, Druid House .....   | 2·60            | „      | Coupar Angus Station .....    | ·69             |
| „     | Okehampton, Oaklands.....      | 4·74            | „      | Blair Atholl.....             | 1·63            |
| „     | Hartland Abbey .....           | 3·23            | „      | Montrose, Sunnyside.....      | ·77             |
| „     | Lynmouth, Rock House .....     | 3·85            | XVII.  | Alford, Lynturk Manse .....   | 2·03            |
| „     | Probus, Lamellyn .....         | 2·54            | „      | Keith, H. R. S. ....          | 2·39            |
| „     | Wellington, The Avenue .....   | 2·18            | XVIII. | Fearn, Lower Pitkerrie.....   | 1·79            |
| „     | North Cadbury Rectory .....    | 1·73            | „      | S. Uist, Askernish .....      | ...             |
| VI.   | Clifton, Pembroke Road .....   | 2·12            | „      | Invergarry .....              | 3·77            |
| „     | Moreton-in-Marsh, Longboro'    | 1·72            | „      | Avienore, Alvie Manse.....    | 1·68            |
| „     | Ross, The Graig .....          | 1·23            | „      | Loch Ness, Drumnadrochit.     | 2·47            |
| „     | Shifnal, Hatton Grange.....    | 1·43            | XIX.   | Invershin .....               | 2·80            |
| „     | Wem Rectory .....              | 1·12            | „      | Altnaharra .....              | 4·49            |
| „     | Cheadle, The Heath House.      | 1·80            | „      | Bettyhill .....               | 4·23            |
| „     | Coventry, Kingswood .....      | 1·59            | „      | Watten, H. R. S. ....         | 2·20            |
| VII.  | Market Overton .....           | 1·16            | XX.    | Cork, Wellesley Terrace ..... | 1·65            |
| „     | Market Rasen .....             | 1·07            | „      | Darrynane Abbey .....         | 4·57            |
| „     | Worksop, Hodsock Priory..      | ·98             | „      | Glenam [Clonmel] .....        | 2·23            |
| VIII. | Neston, Hinderton.....         | 1·78            | „      | Ballingarry, Hazelfort .....  | 2·29            |
| „     | Southport, Hesketh Park...     | 2·04            | „      | Miltown Malbay.....           | 3·45            |
| „     | Chatburn, Middlewood .....     | 5·09            | XXI.   | Gorey, Courtown House .....   | 1·35            |
| „     | Duddon Valley, Seathwaite Vic. | 6·89            | „      | Moynalty, Westland .....      | 2·12            |
| IX.   | Langsett Moor, Up. Midhope     | 4·26            | „      | Athlone, Twyford .....        | 3·53            |
| „     | Baldersby .....                | 1·97            | „      | Mullingar, Belvedere.....     | 1·99            |
| „     | Scalby, Silverdale .....       | 2·87            | XXII.  | Woodlawn .....                | 3·54            |
| „     | Ingleby Greenhow .....         | 2·55            | „      | Westport, Murrisk Abbey..     | 4·07            |
| „     | Middleton, Mickleton .....     | 2·92            | „      | Crossmolina, Enniscoe .....   | 5·55            |
| X.    | Beltingham .....               | 3·74            | „      | Collooney, Markree Obsy..     | 5·39            |
| „     | Bamburgh.....                  | 2·62            | XXIII. | Enniskillen, Portora .....    | 3·24            |
| „     | Keswick, The Bank .....        | 4·18            | „      | Warrenpoint .....             | 1·39            |
| „     | Melmerby Rectory .....         | 3·88            | „      | Banbridge, Milltown .....     | 2·04            |
| XI.   | Llanfrechfa Grange.....        | 2·31            | „      | Belfast, Springfield .....    | 2·87            |
| „     | Treherbert, Tyn-y-waun .....   | 5·85            | „      | Bushmills, Dundarave .....    | 5·08            |
| „     | Llandoverly, Tonn .....        | ...             | „      | Stewartstown .....            | 3·15            |
| „     | Castle Malgwyn .....           | 3·51            | „      | Killybegs .....               | 5·73            |
| „     | Llandefaelog-fach .....        | 3·37            | „      | Horn Head .....               | 5·60            |

## METEOROLOGICAL NOTES ON NOVEMBER, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunder-storm. R for Rain; H for Hail; S for Snow.

## ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Fair and sunny from 2nd to 4th, followed by a week of rough and wet weather during which almost the whole of the month's R fell. From 13th to 18th dense morning fogs prevailed, with high bar. and remarkably little air movement. Wintry conditions set in on 21st and continued till 28th with S on 22nd and 23rd. Duration of sunshine 35·0\* hours and of R 39·1 hours. Mean temp. 42°·0, or 1°·0 below the average.

TENTERDEN.—Wet from 6th to 10th. Sunny from 12th to 15th and on 23rd and 26th. Fog all day on 18th. Frost from 21st to 29th. Duration of sunshine 85·5† hours.

HARTLEY WINTNEY.—The beautiful summer lingered on in mild and calm weather until the 21st, when a sharp snap of winter supervened with extreme cold until the end. Fog from 12th to 20th. Ozone on 16 days, mean 3·8.

HITCHIN.—Very dry and the coldest November since 1858.

TORQUAY, CARY GREEN.—R 2·18 in. below the average. Mean temp. 46°·4, or 1°·1 below the average. Duration of sunshine 96·9\* hours, or 31·5 hours above the average. Mean amount of ozone 3·5.

CLIFTON.—Dull and dry till 5th, with N.E. winds and high bar. Then very wet till 10th, with westerly winds, reaching a gale on 8th and 9th. After heavy R on 21st severe frost set in suddenly and lasted till 28th, with fog on several days and about an inch of S on 23rd. R 1·30 in. below the average.

WORKSOP, HODSOCK PRIORY.—Sharp spell of frost from 21st to 29th was only equalled in November by that of 1890.

BOLTON.—Mild until 20th, but on 21st the wind shifted to N. and the temp. fell rapidly till 24th. Milder weather again on 29th. There was much fog, and during the latter part several falls of S occurred. Duration of sunshine 21·8\* hours, or 3·8 hours below the average.

SOUTHPORT.—The ninth consecutive month with a deficiency of R. Mild generally until 20th and on 29th and 30th, but very cold during the intervening period. Duration of sunshine 3\* hours below the average, and R 1·22 in. below the average. Underground water level unprecedentedly low for November.

LLANFRECHFA GRANGE.—Sharp frost from 21st to 29th and S on 23rd; otherwise mild with a good deal of fog.

## SCOTLAND.

LANGHOLM.—R 1·50 in. below the average of 28 years. S fell heavily all day on 21st, amounting to 13 inches. Roads and railways were blocked and many sheep were lost in the hill districts by drifting.

COLMONELL.—On the 9th occurred the greatest flood for at least 15 years. On 21st 3 inches of S fell, the heaviest in 28 years' records. Mean temp. 43°·3 or 1°·6 above the average of 28 years.

MULL, QUINISH.—Singularly mild and calm, except from 20th to 24th, when there were N. winds and S showers.

\* Campbell-Stokes.

† Jordan.

**COUPAR ANGUS.**—The cold snap commencing on 21st was the most severe since November, 1885. Mean temp. of the month 37°·8, or about 2° below the average. The mean temp. of the last 11 days was 14° lower than that of the first 19.

**DRUMNADROCHIT.**—About a foot of S between 19th and 27th, but no excessive frost and no drifting.

IRELAND.

**CORK.**—R 2·41 below the average. Mean temp. 1°·8 below the average, that of the first 19 days being 48° and of the last 11 days 36°. Rather heavy S on 21st. Fog till 20th, but not dense.

**DUBLIN.**—Very open and generally fine until 19th, when a sudden change to wintry conditions began. Cold and frosty from 20th to 28th inclusive, then mild. S or sleet on 4 days. Fog on 7 days.

**MARKREE OBSERVATORY.**—On 21st S and H set in for 3 days, followed by heavy E on 26th.

**OMAGH.**—Damp and extremely mild until 20th, when a sudden change to squally polar winds was accompanied by the heaviest S since February, 1895, and the lowest temp. in November since 1878. This abnormal weather continued till 27th, but so heavy was the S that it required the mild temp. of many following days to reveal the grass again.

\* \* *Additional information as to the weather of November will be found in the article on p. 201.*

THE ELEVEN MONTHS' RAINFALL OF 1904.

*Aggregate Rainfall for January—November, 1904.*

| Stations.             | Total Rain. | Per cent. of Aver. | Stations.           | Total Rain. | Per cent. of Aver. | Stations.         | Total Rain. | Per cent. of Aver. |
|-----------------------|-------------|--------------------|---------------------|-------------|--------------------|-------------------|-------------|--------------------|
|                       | in.         |                    |                     | in.         |                    |                   | in.         |                    |
| London .....          | 18·87       | 91                 | Arncliffe .....     | 51·73       | 94                 | Braemar .....     | 23·13       | 73                 |
| Teunterden .....      | 21·66       | 90                 | Hull .....          | 19·82       | 86                 | Aberdeen .....    | 23·33       | 81                 |
| Hartley Wintney ..... | 21·49       | 94                 | Newcastle.....      | 21·49       | 92                 | Cawdor .....      | 20·42       | 74                 |
| Hitchin .....         | 19·53       | 92                 | Seathwaite .....    | 114·95      | 96                 | Glencarron .....  | 78·82       | 94                 |
| Winslow .....         | 20·48       | 94                 | Cardiff .....       | 39·88       | 113                | Dunrobin .....    | 25·11       | 91                 |
| Westley .....         | 18·89       | 81                 | Haverfordwest ..... | 37·82       | 98                 | Killarney .....   | 46·11       | 94                 |
| Brundall .....        | 18·95       | 83                 | Gogerddan .....     | 40·06       | 100                | Waterford .....   | 37·36       | 108                |
| Alderbury .....       | 24·24       | 98                 | Llandudno .....     | 22·97       | 83                 | Broadford .....   | 35·38       | 118                |
| Ashburton .....       | 45·55       | 104                | Dumfries .....      | 35·44       | 90                 | Carlow .....      | 29·97       | 99                 |
| Polapit Tamar .....   | 39·60       | 120                | Lilliesleaf .....   | 25·57       | 93                 | Dublin .....      | 20·69       | 83                 |
| Stroud .....          | 24·64       | 100                | Colmonell .....     | 39·50       | 101                | Mullingar .....   | 31·67       | 96                 |
| Woolstaston .....     | 24·13       | 91                 | Glasgow .....       | 31·24       | 96                 | Ballinasloe ..... | 35·79       | 108                |
| Boston .....          | 18·37       | 98                 | Inveraray .....     | 62·73       | 98                 | Clifden .....     | 73·63       | 103                |
| Hesley Hall .....     | 18·18       | 94                 | Islay .....         | 47·53       | 115                | Crossmolina ..... | 54·90       | 118                |
| Derby .....           | 18·52       | 89                 | Mull .....          | 53·37       | 107                | Seaforde .....    | 31·51       | 96                 |
| Bolton .....          | 31·45       | 84                 | Loch Leven .....    | 29·80       | 93                 | Londonderry.....  | 38·68       | 104                |
| Wetherby .....        | 24·04       | 110                | Dundee .....        | 22·90       | 93                 | Omagh .....       | 40·04       | 112                |

## Climatological Table for the British Empire, June, 1904.

| STATIONS.<br><br><i>(Those in italics are South of the Equator.)</i> | Absolute. |       |          |       | Average. |      |            |           | Absolute.    |                | Total Rain. |       | Aver.<br>Cloud. |
|----------------------------------------------------------------------|-----------|-------|----------|-------|----------|------|------------|-----------|--------------|----------------|-------------|-------|-----------------|
|                                                                      | Maximum.  |       | Minimum. |       | Max.     | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth.      | Days. |                 |
|                                                                      | Temp.     | Date. | Temp.    | Date. |          |      |            |           |              |                |             |       |                 |
| London, Camden Square                                                | 76·7      | 30    | 43·1     | 4     | 70·1     | 49·4 | 50·2       | 78        | 126·1        | 38·3           | ·84         | 6     | 6·2             |
| Malta                                                                | 95·2      | 28    | 61·4     | 1, 3  | 83·4     | 67·6 | 64·9       | 72        | 143·6        | 56·3           | ·16         | 3     | 3·0             |
| Cape Town                                                            | 69·5      | 19    | 40·7     | 24    | 61·4     | 48·7 | 48·3       | 73        | ...          | ...            | 6·55        | 17    | 6·6             |
| Durban, Natal                                                        | 90·0      | 24    | 48·8     | 28    | 76·1     | 54·5 | ...        | ...       | 137·2        | ...            | ·66         | 5     | 2·3             |
| Johannesburg                                                         | 65·7      | 6     | 32·5     | 11    | 59·6     | 42·3 | 34·4       | 59        | ...          | ...            | ·31         | 4     | 1·1             |
| Mauritius                                                            | 76·6      | 27    | 54·5     | 30    | 75·3     | 60·9 | 59·8       | 76        | 133·7        | 46·3           | 3·56        | 17    | 5·1             |
| Calcutta                                                             | 101·2     | 6     | 74·2     | 14    | 90·4     | 78·7 | 77·8       | 84        | 157·0        | 73·0           | 10·25       | 19    | 7·7             |
| Bombay                                                               | 92·6      | 7     | 74·6     | 16    | 87·5     | 79·7 | 77·2       | 82        | 138·5        | 73·8           | 15·10       | 25    | 7·1             |
| Madras                                                               | 103·5     | 3     | 79·1     | 28    | 99·8     | 82·0 | 68·4       | 55        | 156·5        | 76·3           | ·61         | 10    | 6·9             |
| Kodaikanal                                                           | 66·2      | 11    | 50·6     | 11    | 61·3     | 52·8 | 51·1       | 84        | 133·6        | 46·0           | 2·60        | 22    | 8·3             |
| Colombo, Ceylon                                                      | 86·4      | 9     | 72·2     | 19    | 84·5     | 76·4 | 70·0       | 79        | 154·5        | 70·0           | 9·51        | 24    | 8·0             |
| Hongkong                                                             | 91·1      | 26    | 72·2     | 1     | 85·0     | 76·0 | 74·1       | 83        | 141·5        | ...            | 19·64       | 17    | 7·2             |
| Melbourne                                                            | 64·9      | 21    | 32·9     | ...   | 64·0     | 33·6 | 44·3       | 81        | 120·1        | 26·8           | 3·29        | 18    | 7·7             |
| Adelaide                                                             | 66·0      | 10    | 41·7     | 4     | 59·2     | 47·1 | 45·2       | 77        | 120·7        | 34·2           | 3·92        | 19    | 7·6             |
| Coolgardie                                                           | 72·1      | 8     | 35·7     | 28    | 60·7     | 44·8 | 44·0       | 72        | 140·2        | 32·1           | 1·40        | 12    | 6·4             |
| Sydney                                                               | 69·6      | 21    | 39·5     | 30    | 59·0     | 44·4 | 40·1       | 77        | 93·8         | 29·1           | ·19         | 11    | 2·2             |
| Wellington                                                           | 63·7      | 15    | 37·9     | 9     | 53·8     | 43·4 | 40·7       | 73        | 98·0         | 33·0           | 6·96        | 20    | 5·8             |
| Auckland                                                             | 62·0      | 2     | 38·0     | 30    | 57·2     | 47·9 | 46·2       | 79        | 115·0        | 34·0           | 6·07        | 24    | 6·5             |
| Jamaica, Negril Point                                                | 88·1      | 1     | 69·9     | 9     | 85·5     | 75·6 | 73·1       | 79        | ...          | ...            | 16·07       | 9     | 8·2             |
| Trinidad                                                             | 88·0      | 2a    | 67·0     | b     | 86·1     | 69·5 | 72·1       | 79        | 161·0        | 63·0           | 6·23        | 14    | ...             |
| Grenada                                                              | 84·2      | 29    | 68·4     | 7     | 82·2     | 73·4 | 70·7       | 78        | 142·0        | ...            | 7·31        | 23    | 5·0             |
| Toronto                                                              | 82·9      | 25    | 44·1     | 23    | 72·1     | 53·6 | 55·1       | 76        | 112·0        | 37·0           | 2·77        | 13    | 5·7             |
| Fredericton                                                          | 83·1      | 24    | 35·0     | 12    | 71·0     | 46·9 | 45·9       | 54        | ...          | ...            | 2·05        | 7     | 4·9             |
| Winnipeg                                                             | 89·0      | 18    | 37·5     | 6     | 71·7     | 50·5 | ...        | ...       | ...          | ...            | 4·22        | 11    | 6·1             |
| Victoria, B.C.                                                       | 79·0      | 29    | 43·2     | 11    | 63·2     | 48·9 | ...        | ...       | ...          | ...            | 1·36        | 5     | 4·7             |
| Dawson                                                               | 74·6      | 3     | 33·0     | 16    | 66·2     | 42·9 | ...        | ...       | ...          | ...            | 1·71        | 7     | 4·5             |

a and 16, 23, 29. b several days.

MALTA.—Mean temp. of air 74°·4 or 2°·9 above the average. Mean hourly velocity of wind 8·0 miles, or 0·8 below average. Mean temp. of sea 71°·1.

MAURITIUS.—Mean temp. of air 1°·0, dew point 1°·3 below, and E 1·51 in. above averages. Mean hourly velocity of wind 9·4 miles, or 1·8 miles below average.

MADRAS.—Bright sunshine 117·8 hours.

KODAIKANAL.—Bright sunshine 68 hours.

COLOMBO.—Mean temp. of air 79°·8, or 1°·3 below, of dew point 4°·1 below, E 1·27 in. above, averages. Mean hourly velocity of wind 11·7 miles.

HONGKONG.—Mean temp. of air 79°·8. Sunshine 162·1 hours. Mean hourly velocity of wind 9·9 miles.

SYDNEY.—Mean temp. of air 2°·7 below, and E 5·30 in. below, averages.

WELLINGTON.—Mean temp. of air 2°·5 above, and E 1·98 in. above, averages.

AUCKLAND.—E 1·75 in. above average of 34 years.

TRINIDAD.—E 2·09 in. below the 40 years average.

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## THE RAINFALL OF 1904.

THE aggregate table of rainfall, given on the penultimate page of the volume, takes the shape this month of a summary of the rainfall for the year. The ratios in the second column of figures refer to the ten years' average, 1890-99; but for the sake of a wider comparison, we refer in the text of this article to the more satisfactory average of the thirty years, 1870-99, which we hope to use exclusively in our next volume. The following discussion formed part of a letter to *The Times*, published on January 10th.

The Table may be studied in various lights, but it does not appear sensational in any. We may look at it, first, according to actual amounts. The area with a rainfall exceeding 40 inches was but little smaller than in an average year, and the wettest places in Cornwall, Devon, Wales and the west of Scotland, seem to have had nearly their average fall. The area with rainfall under 30 inches was, however, very much larger than in an average year, the whole eastern prominence of Scotland, from the Highland railway to Aberdeen and Peterhead—all of which, except the coastal fringe, has usually more than 30 inches—had less than that amount last year; and the whole of England below the level of about 600 feet, seems also to have had less than 30 inches. The lowest rainfall, that under 20 inches, was found in southern and eastern Essex, and in the counties of Suffolk, Cambridge, Huntingdon, Northampton, and Nottingham. The extremes of rainfall noted were 129·33 at Seathwaite, and 16·09 at Shoeburyness.

We may next consider the Table with relation to the average. The distribution of variation from the average was interesting, and may be expressed by saying that the whole Atlantic border of the British Isles, from Cornwall through the west of Ireland and the west of Scotland to Shetland, had more than the average amount of rain, while the continental aspect of the country had less than the average amount. The excess was most marked in the west of Ireland, the greatest that appears being 18 per cent. at Crossmolina, but the east of Ireland was so dry that the whole island exceeds the average by just 1 per cent. The wet western fringe of Scotland

included the Hebrides and the extreme west coast, though it seems to have spread across the Lowland Valley to the Firth of Forth. For the whole of Scotland, so far as we can judge in the absence of several old Highland records recently allowed to lapse, the year showed a deficiency of 8 per cent. This was due mainly to the exceptional dryness of the east coast, especially in the great triangle cut off by a line drawn from Dundee to Inverness. Braemar appears to have been relatively the driest point in the British Isles, the amount recorded for 1904 showing a deficiency of 31 per cent. from the average.

In England and Wales only a few coast stations, chiefly on the Bristol Channel and in Cornwall, and some on the South Downs, showed an appreciable excess of rainfall; as a whole there was a deficiency of 12 per cent. The driest region occupied the Midlands and extended to the Severn on the south-west, the Humber on the north-east, and Yarmouth on the east. The whole of this area had a deficiency exceeding 20 per cent., and at Wisbech it was as great as 29 per cent. The north of Norfolk and the whole of Lincolnshire seem to have escaped the drought.

Taking the British Isles together, the deficiency of rainfall in 1904 does not seem to have exceeded 8 per cent., so that it may be classed as a moderately dry year, though not quite so dry as 1902, to which dull, ungenial weather gave a bad, but undeserved, name for raininess.

### WEATHER INFLUENCES—A REVIEW.

PROFESSOR E. G. DEXTER, who occupies the chair of Education in the University of Illinois, has written a very important book\* on the influence of weather on human life and conduct. We are accustomed to think and speak, in a general way, of the weather as affecting not only our physical comfort, but the state of our nerves as well. Such words as "relaxing" and "bracing," applied to climates, cover vaguely a mass of semi-instinctive and wholly indefinite knowledge in which we all believe, though few of us could give any scientific grounds for our belief. Dr. Dexter has made a bold attempt to investigate the influence of weather on human feelings and faculties by exact statistical methods, and he has reached certain conclusions, so definite and so well established by evidence as to command complete confidence for the places and in the climates which he has studied. There is no subject more attractive to the mentally active, but untrained in science, than weather, its effects and its causes. One opens a new book on these matters with trepidation, fearing that it may prove another instance of pathetic

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\* "Weather Influences, an empirical study of the mental and physiological effects of definite meteorological conditions." By Edwin Grant Dexter, Ph.D., with introduction by Cleveland Abbe, LL.D. New York: The Macmillan Company; London: Macmillan & Co. 1904. Price 8/6, net.

delusion, or cunning charlatanism, and great was the relief on this occasion when chapter after chapter showed that Dr. Dexter, although not professing any special knowledge of meteorology, was a master of scientific method, and a living example of scientific caution.

In the introduction, Professor Cleveland Abbe gives a valuable summary of the earlier literature of the subject, and deals with the question of the direct and indirect influence of climate on mankind, a larger question than that attacked by Dr. Dexter, who carefully limits his study to the effects of weather. Incidentally, however, he touches on climate, and in so doing he makes a somewhat serious blunder. Speaking of the effect of temperature, he asserts that north of  $55^{\circ}$  N., the vital energy is so much drawn upon to counteract the low temperature, that there is little left for those activities which make leaders. We venture to think that the history of Scotland, of Norway, of Sweden, and of Iceland, refutes this rather random rule.

The first four chapters deal pleasantly and freshly with such familiar themes as weather lore, proverbs, and weather influences, in literature. Then comes a statement of the empirical problem to the solution of which the author set himself. He states it thus:—

“For any given community of limited area, a change in weather conditions means a change in the environment for every inhabitant. If this change in the environment tends to influence conduct, and any statistics of conduct are kept, their study in connection with the records of the weather would disclose the fact. It is just this problem with which our study deals. It is an attempt, by empirical methods, to discover the influence of the weather upon human behaviour. It has nothing to do with the permanent or racial effect of prevailing meteorological conditions, but with the immediate and temporary effect of definite fluctuations of these conditions. In other words—not of climate, but of weather.”

Two cities were selected for this detailed study: New York, at sea-level on the Atlantic coast, and Denver, in Colorado, on a plateau 5,200 feet above the sea, in the heart of the continent. Statistics of conduct, or, as it is termed in America, deportment, were obtained from certain prisons and schools, and of crimes from police courts and newspapers, the total number of cases tabulated being very large indeed, and occurring during ten years.

“In the tabulation the average daily occurrence for all the days falling under a given meteorological condition, was compared with the average daily occurrences for the whole period studied, and an excess or deficiency was ascribed to weather influences. The right to do this might at first thought be questioned, but . . . There is, in fact, but one condition in the environment which changes simultaneously for all the individuals considered, and that is the weather.”

It is not suggested that the weather influences moral conduct directly, but that in certain conditions of weather a state of mind is produced in which the power of resistance to temptations, which

in themselves have nothing to do with atmospheric conditions, is weakened or strengthened. The method employed was limited to an investigation of mean barometer, temperature, humidity, total wind movement, character of the day, and precipitation. These data were got out for every day of all the years under investigation. The days were then separately classified for certain small ranges of each of the meteorological conditions, and a curve of expectancy was prepared by which to judge the accordance of the department statistics. Thus if 1 per cent. of all the days considered had a range of temperature between  $30^{\circ}$  and  $35^{\circ}$ , and 10 per cent. had a range between  $70^{\circ}$  and  $75^{\circ}$ , it would be expected that if suicide had no relation to temperature, the total number of suicides during the latter period would be ten times as great as during the former. However, in drawing the curves, all the values are reduced to the excess or deficiency of the daily averages for the period in question, with respect to the expectancy curve, so as to obviate the confusion likely to arise from the mere magnitude of the number.

A series of chapters deals in succession with the influence of the weather on the conduct of children in school, on various forms of crime, on insanity, on health, on suicide, on drunkenness, and on attention, each one illustrated by a series of curves, one for each of the meteorological conditions examined. A general chapter summarizes all the foregoing, and from it rather than from the detailed discussion we draw the following conclusions.

So far as the seasonal occurrence of the conditions studied is concerned, it appears that in the cold months sickness, death, and drunkenness are far more frequent than in the warm months; whereas crime and suicide are most developed in the summer. The effects of temperature (without regard to season) are shown much more distinctly in the case of females than of males, especially in the increase of pugnacity and of "mental unbalancing" in hot weather.

Contrary to one's expectation, the influence of barometric pressure was found to be more distinct than that of any other meteorological condition. A low barometer is characterized by increase in crime, insanity and bad conduct; sickness and suicide also seem to be increased, while drunkenness is diminished, and attention, as tested by the number of clerical errors made by bank clerks, is either more perfect, or special precautions are taken to guard against errors.

Humidity may be dismissed with the remark that a dry atmosphere is a stimulant to all forms of active disorder and to suicide, but is an enemy to intoxication and mental inexactness.

With regard to wind, the most remarkable results ascertained are that calms produce an excessive development of those life phenomena which are due to depleted vitality. Thus crime, insanity and bad conduct in school and prison, drop to a very small frequency, in the case of females especially, while sickness, death, and want of attention, are above the average, and there is a tremendous increase in

the number of absences from school. These facts are explained by the statistics being compiled from large cities, where an absence of wind means stagnation of the atmosphere and the accumulation of carbonic acid and other deleterious constituents. Fogs are not treated specially, but they no doubt assist in intensifying the depressing effects of calms. The diminution in crime and misconduct are due obviously to lack of strength or spirit, not to any tendency to a higher morality in calm weather.

In conclusion, we present Dr. Dexter's final epitome in his own words, some of which will require a careful study of his volume to explain fully, but we feel considerable confidence in accepting the various propositions, after reading the ample proofs presented in his pages.

I.—Varying meteorological conditions affect directly, though in different ways, the metabolism of life. II.—The "reserve energy" capable of being utilized for intellectual processes and activities, other than those of the vital organs, is affected most by meteorological changes. III.—The quality of the emotional state is plainly influenced by the weather states. IV.—Although meteorological conditions affect the emotional states, which without doubt have weight in the determination of conduct in its broadest sense, it would seem that their effects upon that portion of the reserve energy which is available for action are of the greatest importance.

The outcome of the whole study is, that crimes of violence and bad conduct in school or in prison are due to excessive vitality imperfectly controlled, and their frequency is increased by whatever conditions of weather increase vitality; while illness, insanity, and death, result from deficient vitality, and work greater havoc when depressing atmospheric conditions prevail.

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## ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, December 21st, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

An interesting discussion took place on Mr. F. J. Brodie's paper on the "Decrease of Fog in London during recent years," which was read at the previous meeting. [For a summary of this paper, see p. 213]. By an apt coincidence, a remarkably dense fog prevailed throughout the day, and so added special emphasis to the occasion.

The President was of opinion that fogs were due to meteorological effects. The presence of dust in the atmosphere was often invoked to explain the formation of fog, but he did not think that was correct, as at sea, where there could not be much dust, fogs were quite as dense as London fogs, only cleaner.

Mr. W. Marriott thought that Mr. Brodie should have clearly

stated what he meant by the term fog, as by speaking about "town fog" one was almost led to suppose that he had dealt only with what was popularly called "London fogs," and not fogs in the ordinary or meteorological acceptance of the term. The International Meteorological Congress of Vienna had adopted the same symbol for both fog and mist, which they evidently believed to be phases of the same phenomenon. Mr. Marriott exhibited some lantern slides, showing by symbols the meteorological phenomena observed at the stations of the Royal Meteorological Society, as printed some years ago in the *Meteorological Record*, and pointed out how his own observations of fog at West Norwood were confirmed by those of Mr. Mawley at Addiscombe. These gave a greater number of days of fog than were recorded in Mr. Brodie's paper for Brixton. Mr. Marriott believed that there was a considerable connection between fogs and the absence of wind. He showed lantern slides on which were given curves of the number of occasions on which the velocity of the wind at the Royal Observatory, Greenwich, was less than 200 miles per day. These curves corresponded in a very remarkable manner with those of the days of fog at West Norwood.

Mr. J. E. Clark described the means which he had employed at his office at Finsbury Square, E.C., for measuring the amount of darkness in the daytime by noting the number of quarters of an hour that it was necessary to resort to artificial light. [See this Magazine, 36, p. 94].

Dr. W. N. Shaw thought that Mr. Marriott's suggestion that fog was most prevalent when there was an absence of wind was probably correct. This was confirmed by the inquiry on "London fogs" taken in hand by the Meteorological Office for the London County Council, as one of the difficulties of the second winter's work was the marked decrease of fog owing to the increase of wind.

Mr. C. Harding was of opinion that wind was a very important factor in connection with the matter under discussion, and referred to the instances in which fog was prevalent when the velocity of the wind at the Royal Observatory, Greenwich, was less than 100 miles per day.

Dr. H. R. Mill said that he had compared Mr. Brodie's figures with those of the number of rainy days and the amount of rain at Camden Square; and found that very often a year which had frequent fogs had few rainy days or little rain, while a year with few fogs had many rainy days or much rain. This relationship is not surprising, for if the years in which fogs are frequent are those in which anticyclonic conditions have been predominant or at least unusually common, they should be dry years as well; while years of frequent cyclonic disturbances ought to be wet and free from fogs.

Captain W. F. Caborne spoke on the work of the Coal Smoke Abatement Society; and letters were read from Mr. A. A. Pearson and the Hon. F. A. Rollo Russell, referring to the influence in

reducing fogs of the increasing number of paved streets and of slate roofs in London.

Mr. F. J. Brodie, in reply, said that he thought it would be found that dust was present in even sea fogs, although not to the same extent as on land. He had used the Brixton figures in his paper because they were the official figures. He thought the connection between fog and absence of wind must be patent to everybody, and that there could not be a London fog when a wind of force 3 or more was blowing.

A paper by Dr. W. N. Shaw, F.R.S., and Mr. W. H. Dines, was also read. The authors described an apparatus called the "Micro-Barograph," which they have designed to magnify the minor fluctuations and at the same time to disentangle them from the general barometric surges. They also showed some interesting records from three of these instruments—two being at South Kensington and the other at Oxshott. The authors wish to obtain information as to the nature of the disturbances and the causes to which they may be assigned. Among the causes which suggest themselves as likely to produce temporary fluctuations of the barometric curves are—(1) Atmospheric billows passing along surfaces where there is discontinuity of density in a manner somewhat similar to ocean waves; (2) the passage of minute whirls, or cyclonic depressions of small dimensions; (3) variations of pressure due to the attraction or repulsion produced by electric stress as masses of air at different potential pass by; (4) the mechanical effects of wind; and (5) the mechanical effects of the rapid condensation of aqueous vapour.

The following gentlemen were elected Fellows of the Society:—Mr. W. H. Chambers Bullen, Dr. H. A. Des Vœux, Mr. R. G. K. Lempfert, M.A., and Mr. R. M. MacFarlaine.

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### SCOTTISH METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on December 6th at 4 p.m., in the rooms of the Royal Society of Edinburgh, the Hon. Lord M'Laren in the chair.

Dr. W. N. Shaw, F.R.S., communicated an important paper on "The Treatment of Climatological Observations." The practice of summarising observations in the form of weekly and monthly means and extremes was convenient, and the results for some purposes valuable, but since the actual weather of the British Isles does not arrange itself in such regular periods, a system of classification which dealt with consecutive weekly or monthly divisions as homogeneous left something to be desired for certain problems. The distribution of barometric pressure from day to day might be adopted usefully as a basis of classification, and the object of the inquiry, towards which the paper was a first contribution, was threefold:—

First, to combine the climatological data in such a way as to exhibit effectively the modifying influence of geographical position upon the general weather conditions of the locality. Second, to mark out in clear outline and give numerical expression to the specific characteristics of weather associated with distributions of pressure which may be regarded as typical. Third, to secure the co-operation of the observers at the normal climatological stations in filling in the outline by putting together the data for their stations, as they are obtained, upon some plan organized by mutual agreement.

Six different types of isobaric distribution might be distinguished :—

- I. S.E. Type.—A pressure distribution favourable for S.E. winds, or, according to the amount of incurvature, for E. winds.
- II. S.W. Type.—For winds from S.W., or from some point nearer S.
- III. N.W. Type.— „ „ „ N.W., „ „ „ „ „ W.
- IV. N.E. Type.— „ „ „ N.E., „ „ „ „ „ N.
- V. Variable Cyclonic Type, with the sequence of winds incidental to the passage of a cyclonic depression.
- VI. Variable Anticyclonic Type, with the uncertain winds of the interior of an anticyclonic region.

This was, of course, not an exhaustive classification ; indeed, each of the first four types might be conveniently subdivided into three, according as any station was in a position where the isobars were concave towards the low pressure area, nearly straight, or concave towards the barometric maximum.

So far the inquiry had extended to groups of stations in the districts named and for the periods indicated in the following table, which gives the number of days in the different periods that might be referred to the several types :—

| TYPE.                        | England N.W.<br>1896-1898. |       | Midland Counties.<br>1897-1899. |       | Scotland E.<br>1897-1899. |
|------------------------------|----------------------------|-------|---------------------------------|-------|---------------------------|
|                              | January.                   | July. | January.                        | July. | January.                  |
| I. S.E. ....                 | 13                         | 2     | 11                              | 7     | 11                        |
| II. S.W. ....                | 40                         | 35    | 32                              | 19    | 43                        |
| III. N.W. ....               | 18                         | 28    | 12                              | 27    | 18                        |
| IV. N.E. ....                | 13                         | 6     | 14                              | 13    | 5                         |
| V. Variable Cyclonic.....    | 7                          | 8     | 5                               | 6     | 5                         |
| VI. Variable Anticyclonic... | 2                          | 14    | 19                              | 21    | 11                        |

The data for the first two districts were for periods with only two years in common, but the January data for Scotland E. and for the Midland Counties of England for one and the same period showed a relative preponderance of the S.W. and N.W. types in the more northern district and represented definitely a difference of climatic conditions for the two districts.

The weather of each station in each group had been analysed as regards rainfall, temperature, &c., and the results gave a definite

measure of the peculiarities of any place or district for any type of weather. Thus in July, both in England N.W. and in the Midland Counties, the dryness of the N.W. and N.E. types was well marked, as also the irregularities of the distribution of rainfall with the variable cyclonic type of weather. Again, in Scotland E. in January there were high temperatures with the N.W. type and low temperatures with the S.W. type, a marked absence of sunshine with the S.E. type, and irregular rainfall with the N.E. type.

Altogether, the method of distributing the observations according to weather types brought out a number of striking points which would be masked or obliterated if only weekly or monthly averages were used. The student of meteorology would be able to get :—

A much clearer and more definite insight into the facts of meteorology by bringing to the numerical test a number of statements which have long been recognised in a more vague and general form.

Such work was necessarily laborious, but might be lightened by the co-operation of observers in the various districts.

The paper was fully illustrated by diagrams and lantern slides.

A short paper on "The Vertical Gradient of Rainfall," by Mr. A. Watt, M.A., was also communicated. The 19 years' series of rainfall records from the Ben Nevis Observatories showed, somewhat unexpectedly, that the ratio of the amount of rainfall at the top of the mountain to that at the foot exhibited very little variation from month to month. On the other hand, comparing the rainfall on the Puy-de-Dôme with that at its base station, Clermont, for an 18 years' period, we had a radically different curve, the two sets of monthly ratios being as follows :—

|                                 | J.  | F.  | M.  | A.  | M.  | Ju. | Jy. | A.  | S.  | O.  | N.  | D.  |
|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <i>Ben Nevis</i> , Fort William | 1·9 | 1·9 | 2·3 | 2·2 | 2·3 | 2·2 | 2·3 | 2·2 | 2·1 | 2·0 | 2·0 | 1·9 |
| <i>Puy-de-Dôme</i> , Clermont   | 5·5 | 4·5 | 4·2 | 2·8 | 1·8 | 1·6 | 1·7 | 1·8 | 1·8 | 2·3 | 2·9 | 4·6 |

The two Scottish stations had much heavier rainfalls than the two French ones, and only the general character and not the amplitude of the two curves was in consideration, especially since differences of height might affect the problem. The speculation was indulged in that the difference of the curves could be accounted for on the following suppositions :—(1). That the greater part of the Ben Nevis rainfall was of cyclonic origin, since there did not seem any theoretical reason why the gradient of rainfall of purely cyclonic origin in a mountainous district should have a seasonal variation ; (2). That a great part of the Central France rainfall was of local convectional origin. The zone of maximum rainfall of such origin varied greatly in height with the seasons—as explained by Hann and others—and would certainly be in summer far above the level of the Puy-de-Dôme, and in winter probably below that level. But all rainfall problems were complex, especially those dealing with high-levels, since the mass of a mountain had a double influence—in deflecting winds upwards and in setting up or assisting local convectional currents in warm weather.

## CLIMATE OF THE BRITISH EMPIRE IN 1903.

THE completion of the climatological records of the British Empire for 1903 enables us once more, and for the twenty-second time, to summarise the observations for a year. It is gratifying to notice that out of the sixteen stations which appeared in the table for 1882 no fewer than thirteen are among the twenty-five for which it is possible to give more or less complete records for 1903. It is, however, still obviously impossible to represent the average conditions of the climate of the Empire by so small a number of stations, however well distributed; but the records do display the diversity of the many climates of our scattered dominions.

Adelaide, which has almost constantly held the first place in the summary for extreme maximum temperature, is, as in 1902, naturally outshone by Coolgardie, in Western Australia, which comes to the front with the notable shade temperature of  $113^{\circ}\cdot4$ , the second highest reading we have ever had occasion to quote. It must be remembered, however, that we do not publish returns from any of the intensely hot stations in the north-west of India. The minimum temperatures at Dawson are unprecedented in these tables, as this station has only been at work for a few years, and the winter returns have frequently been imperfect.

It is of interest in connection with the extremely wet character of 1903 over the greater part of the British Isles to note that the rainfall of London was the highest ever recorded there. The rainfall elsewhere showed no tendency to be exceptional, and more stations had a deficiency than an excess.

The range of shade temperature in the British Empire in 1903 was  $174\cdot2$  Fahrenheit degrees, between the Coolgardie maximum and the Dawson minimum; and it is a tribute to the power of gold in attracting population to uncomfortable places that thousands of miners brave the torrid heat of the Coolgardie summer, and the more than polar cold of the Dawson winter.

## SUMMARY.

|                                        |                                                  |
|----------------------------------------|--------------------------------------------------|
| <i>Highest Temp. in Shade</i> .....    | $113^{\circ}\cdot4$ at Coolgardie, on Jan. 27th. |
| <i>Lowest</i> " " .....                | $-60^{\circ}\cdot8$ at Dawson, on Jan. 26th.     |
| <i>Greatest Range in year</i> .....    | $150^{\circ}\cdot3$ at Dawson.                   |
| <i>Least</i> " " .....                 | $22^{\circ}\cdot8$ at Grenada.                   |
| <i>Greatest Mean Daily Range</i> ...   | $23^{\circ}\cdot5$ at Winnipeg.                  |
| <i>Least</i> " " " " .....             | $8^{\circ}\cdot5$ at Hong-Kong.                  |
| <i>Highest Mean Temp. in Shade</i> ... | $82^{\circ}\cdot3$ at Madras.                    |
| <i>Lowest</i> " " " " .....            | $22^{\circ}\cdot8$ at Dawson.                    |
| <i>Highest Relative Humidity</i> ...   | $82\%$ at London.                                |
| <i>Lowest</i> " " " " .....            | $62\%$ at Adelaide.                              |
| <i>Highest Temp. in Sun</i> .....      | $177^{\circ}\cdot0$ at Trinidad, on Nov. 14th.   |
| <i>Greatest Rainfall</i> .....         | $93\cdot67$ in. at Hong-Kong.                    |
| <i>Least</i> " " .....                 | $10\cdot74$ in. at Dawson.                       |
| <i>Most Cloud</i> .....                | $6\cdot8$ at Hong-Kong.                          |
| <i>Least</i> " " .....                 | $3\cdot3$ at Grenada.                            |

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1903.

| STATIONS.<br><i>Those in Italics are South of the Equator.</i> | ABSOLUTE. |              |                   | AVERAGE.        |      |      |       | ABSOLUTE.  |           | RAINFALL.    |                | AVER-<br>AGE. |        |
|----------------------------------------------------------------|-----------|--------------|-------------------|-----------------|------|------|-------|------------|-----------|--------------|----------------|---------------|--------|
|                                                                | Temp.     | Date.        | Minimum.<br>Temp. | Date.           | Max. | Min. | Mean. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Days.         | Cloud. |
|                                                                |           |              |                   |                 |      |      |       |            |           |              |                |               |        |
| London                                                         | 87.2      | July 10      | 22.1              | January 16      | 58.2 | 44.0 | 51.1  | 45.5       | 82        | 133.7        | 17.3           | 179           | 0-10   |
| Malta                                                          | 100.3     | Sept. 13     | 42.5              | Feb. 4, 19      | 71.5 | 58.2 | 64.8  | 56.3       | 78        | 148.7        | 37.1           | 63            | 6.1    |
| Lagos                                                          | 93.0      | March 8      | 68.0              | Jan. 1, Sep. 28 | 86.2 | 75.6 | 80.9  | 56.3       | 78        | 148.0        | ...            | 108           | 3.5    |
| Cape Town                                                      | 92.1      | February 11  | 37.7              | July 1, 25      | 68.5 | 53.7 | 61.0  | 51.5       | 73        | ...          | ...            | 120           | 4.6    |
| Durban                                                         | 96.1      | Sept. 29     | 46.1              | June 27         | 79.2 | 61.3 | 70.2  | 51.5       | 73        | ...          | ...            | 145           | 4.5    |
| Mauritius                                                      | 89.0      | January 10   | 55.1              | July 13         | 80.8 | 67.0 | 73.9  | 65.4       | 75        | 152.3        | 45.3           | 209           | 5.9    |
| Calcutta                                                       | 107.6     | April 29     | 48.9              | January 1       | 87.8 | 70.7 | 79.3  | 68.4       | 72        | 160.0        | 41.9           | 79            | 4.6    |
| Rombay                                                         | 93.7      | May 22       | 56.0              | December 27     | 85.5 | 74.1 | 79.8  | 71.1       | 76        | 140.7        | 48.9           | 111           | 3.8    |
| Madras                                                         | 103.1     | June 27      | 65.3              | December 8      | 89.7 | 74.9 | 82.3  | 72.6       | 79        | 147.1        | 60.5           | 104           | 4.6    |
| Kodaikanal                                                     | 74.5      | March 23     | 42.7              | December 14     | 64.7 | 51.4 | 58.1  | 48.4       | 76        | 152.1        | 28.7           | 120           | 5.8    |
| Colombo                                                        | 94.0      | March 14     | 68.5              | February 1, 3   | 87.0 | 75.9 | 81.5  | 73.8       | 81        | 155.8        | 62.2           | 182           | 5.8    |
| Hong-Kong                                                      | 92.4      | July 31      | 41.9              | February 3      | 76.3 | 67.8 | 72.0  | 63.8       | 77        | 147.5        | ...            | 135           | 6.8    |
| Melbourne                                                      | 105.0     | January 31   | 28.4              | June 11         | 66.9 | 49.8 | 58.3  | 47.6       | 72        | 165.3        | 20.5           | 130           | 6.4    |
| Adelaide                                                       | 105.6     | February 9   | 32.2              | July 11         | 71.1 | 52.8 | 61.9  | 47.9       | 62        | 161.9        | 27.5           | 134           | ...    |
| Coolgardie                                                     | (113.4)   | (January 27) | 34.4              | August 3        | ...  | ...  | ...   | ...        | ...       | (173.6)      | 27.3           | ...           | ...    |
| Sydney                                                         | 98.1      | February 3   | 38.4              | June 26         | 69.2 | 56.7 | 63.0  | 50.4       | 73        | 139.5        | 29.8           | 197           | 5.4    |
| Wellington                                                     | 79.5      | November 30  | 31.0              | August 2        | 61.2 | 48.5 | 54.8  | 46.2       | 74        | 138.0        | 21.0           | 179           | 6.2    |
| Auckland                                                       | 78.0      | February 15  | 34.0              | July 16         | 63.9 | 53.2 | 58.6  | 49.4       | 72        | 150.0        | 32.0           | 194           | 5.3    |
| Jamaica                                                        | 92.1      | August 10    | 61.0              | November 30     | 86.3 | 72.0 | 79.1  | 70.8       | 76        | ...          | ...            | 105           | ...    |
| Trinidad                                                       | 96.0      | June 1       | 56.0              | Sept. 30        | 87.0 | 69.2 | 78.1  | 71.4       | 78        | 177.0        | 60.0           | ...           | ...    |
| Grenada                                                        | 92.4      | April 30     | 69.6              | March 13        | 84.5 | 74.2 | 79.4  | 70.6       | 74        | 157.2        | ...            | 232           | 3.3    |
| Toronto                                                        | 91.5      | July 8       | — 9.7             | December 28     | 54.4 | 37.7 | 46.0  | 39.1       | 76        | 110.7        | —13.5          | 95            | 6.1    |
| Winnipeg                                                       | 93.8      | July 23      | — 36.7            | February 15     | 46.8 | 23.3 | 35.1  | ...        | ...       | ...          | ...            | ...           | 4.9    |
| Victoria, B.C.                                                 | 87.8      | June 8       | 26.4              | March 12        | 54.8 | 43.9 | 49.3  | ...        | ...       | ...          | ...            | ...           | 6.7    |
| Dawson                                                         | 89.5      | June 19      | — 60.8            | January 26      | 32.3 | 13.4 | 22.8  | ...        | ...       | ...          | ...            | 59            | 4.0    |

1 December wanting.

## Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

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## FOG IN LONDON.

THIS morning at 9 a.m. I measured .04 in. of "rain," consisting of condensed fog for previous 24 hours. I have never measured so much before, and think it worthy of note.

As to fogs being less prevalent in the London district during the last 10 years, as described in your report of the recent meeting of the Royal Meteorological Society, is not that probably due to the mild cyclonic type of the last 9 out of 10 winters?

STANLEY SINGLE.

*Park View, Leopold Road, Wimbledon, Dec. 20th, 1904.*

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WITH regard to the dispersal of fogs, it has often occurred to me that by creating a wind or breeze from different portions of the City and suburbs, fogs might be dispersed or perhaps mitigated.

My idea is to have large shallow tanks, or long narrow troughs, in various open spaces or on eminences; these to be charged with naphtha, methylated spirit, or some other quick burning and smokeless material, that on ignition would produce a sudden and violent flame, which would cause a current of air.

How far is such a scheme practicable? As to the expense, this I imagine would be a mere trifle compared with that of the loss, and inconvenience, not to say sickness due to fog.

J. C. STENNING.

*Steel Cross House, Tunbridge Wells, 23rd Dec., 1904.*

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IN connection with the above, we may quote the following letter from Sir Oliver Lodge, Principal of the University of Birmingham, which appeared in *The Times* of December 23rd.

*To the Editor of The Times.*

SIR,—The anticyclonic condition prevalent this year gave us a fine summer and is now giving us an opportunity for fog which the great towns are utilizing to the utmost by the imperfection of their combustion and by their habitual employment of crude fuel.

An electrical method of dissipation is not the right remedy for this artificially intensified evil, though it is a hopeful and proper method of attacking natural mist in places where it interferes with navigation or commerce; but, although it is not the right remedy, any more than free meals and free doles are a sound remedy for the problem of poverty, yet, like them, it may have to be used as a temporary palliative in times of stress and while better methods are incubating. The cost of applying such a method to a whole city is probably prohibitory, but there are important

centres where any means of mitigating the nuisance would seem to be legitimate.

If a deputation of municipal or other engineers chose to come to Birmingham, I would show them some apparatus at work, and they could judge how far they could recommend its experimental adoption on a larger scale. No private persons can try experiments in the thoroughfares of a city, nor can an experiment be tried on an adequate scale without some expenditure. The necessary expenditure resolves itself into initial equipment and maintenance; the actual running expense being only occasional, and, moreover, quite insignificant, compared with the power already expended in artificial illumination during daylight fog.

Whether it is worth while for any municipality to try the experiment, it is not for me to say, but it is within the scope of the electrical engineering profession, and my assistants are competent to give the specific supervision and advice necessary to insure its being tried properly, if any authority chose to attempt it.

I am, Sir, faithfully yours,

OLIVER LODGE.

*The University, Birmingham, Dec. 23rd.*

### RAIN GAUGES.

THERE are two sources of error in rain gauges which are more important than any which have been discussed lately in this Magazine.

(1.) There is the difference in sharpness of the rim. For five years my neighbour in this village registered an average of 1.03 in. yearly more than I did, and we were unable to assign a reason; both gauges were Snowdon 5 in. On his leaving the village he allowed me to place his gauge alongside mine for some months, during which it still registered more than mine. Careful measurement showed that his gauge was a trifle wider than mine, only sufficient to cause a difference of 1 per cent., but the rim was not so sharp as mine—one of Casella's, which, as Mr. Symons said, would split a rain drop,—and the higher record was probably due to insplashing.

(2.) The other source is the difference in receptacle. Some deliver direct into the copper cylinder or bucket, others into a wide mouthed bottle; in both cases, if the gauge is not read daily evaporation comes in. A neighbour here, who only records his gauge once a month, registered actually less at the end of the month than he had found in it some days before; the weather had been dry, and his funnel delivered direct into the copper bucket of a Snowdon gauge.

Rain gauges should have rims uniformly sharp, and delivery should be into a glass bottle with a mouth only just wide enough to take the funnel pipe.

J. P. MACLEAR.

*Chiddingfold, 15th October.*

## METEOROLOGICAL NEWS AND NOTES.

THE LARGEST NUMBER OF THIS MAGAZINE, completing the largest volume which has been issued since its foundation in 1866, is now in the hands of the reader. We could without difficulty maintain the size throughout the year, as our correspondents keep us amply supplied with material ; but, although the Magazine can never be expected to become a source of financial profit, we hope that the small increase of circulation which has been observed will continue until the loss incurred in improving the Magazine is covered. The next volume will appear in the attractive cover the design of which appears as the frontispiece of the present ; and if our readers care for it enough to increase the circulation sufficiently to cover the extra expense of printing and the doubled postage which any expansion demands, it lies in their power to do so. We shall not cease in our efforts to fill such space as our subscribers place at our disposal to the best of our ability.

THE PHYSICS OF THE FREE AIR—that is to say, the scientific investigation of the upper atmosphere—is the subject of a new publication appearing at irregular intervals under the title *Beiträge zur Physik der freien Atmosphäre*. The new journal is edited by Dr. Assmann, of Berlin, and Dr. Hergesell, of Strasburg, with the collaboration of eminent meteorologists in all countries.

THE ROYAL METEOROLOGICAL SOCIETY is, we understand, about to resume the series of exhibitions of meteorological instruments, which were for some years a source of great interest to the public as well as to the Fellows of the Society.

THE COURSE OF GILCHRIST LECTURES to be delivered in January at Evesham, Stourport and Wolverhampton, and in February at Swadlincote and Atherton, will include a lecture on Climate and its Influence on Human Progress by Dr. H. R. Mill.

ASTRONOMY AND METEOROLOGY are on good terms with each other. They approach though they do not meet ; but we confess to a sensation of mild surprise at the far views of a provincial journalist, who, in an eloquent tribute to the dry October, printed on November 1st, permits himself to observe—"With a regular afternoon sun and a gentle dry wind we are placidly approaching the autumnal equinox." We may add that we are also approaching the 29th of February.

## REVIEWS.

*Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus herausgegeben von Professor DR. G. HELLMANN. No. 15. Schlussheft. Denkmäler Mittelalterlicher Meteorologie.* [Reprints of Works on meteorology and terrestrial magnetism. No. 15, concluding number. Monuments of mediæval meteorology.] Berlin: Asher & Co. 1904. Size 10 × 8. Pp. 46 + 270 + 12. Price 28 mk.

THIS beautiful volume completes the series of monumental works of the past, which Dr. G. Hellmann has brought for a moment within the reach of the students of meteorology of to-day. We say "for a moment" because the first four numbers are already out of print and the whole series is so interesting bibliographically as well as scientifically that the edition will soon be exhausted.

To this volume Dr. Hellmann prefixes an introduction dealing with the character of the meteorology of the Middle Ages, in which he says that the proverbial darkness was pierced by the light of many brilliant stars, and in confirmation of this he gives a series of most interesting notes on the works he has selected for reproduction. These are, of course, mainly in Latin, and the actual manuscripts are reproduced in many cases and always with a perfection that does the greatest credit to publishers and printers. The first chronologically is a selection from the *De Natura Rerum* of Isidorus Hispalensis (A.D. 570-636), a famous bishop of Seville; the last is from Gregor Reisch's *Margarita Philosophica*, a miniature encyclopædia written at the beginning of the fifteenth century and printed long afterwards, in 1504. This edition, the meteorological section of which is reproduced, contains the first meteorological pictures and diagrams which figured in any printed book. The nine centuries between these two works are represented by 24 authors, including the first English historian, the Venerable Bede. The intellectual side of meteorology will always lie under a delightful debt to Dr. Hellmann for this series.

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*Climatological Observations at Colonial and Foreign Stations. I., Tropical Africa, 1900-1901-1902. With Summaries for previous years and frontispiece map. Tables prepared by E. G. RAVENSTEIN.* Published by the Authority of the Meteorological Council. London: Printed for H.M. Stationery Office, 1904. Size 12 × 10. Pp. 54 and Map. Price 6s.

IN a short preface Dr. W. N. Shaw explains that the Meteorological Council intend to publish the observations from distant portions of the British dominions and certain foreign countries which are sent in to the Meteorological Office, and they have accepted this discussion by Mr. Ravenstein as a preliminary memoir. The first two para-

graphs of the preface explain the origin of the present publication:—

“Summaries of Climatological Observations made at a number of stations in Tropical Africa have been included in a series of reports made to the British Association by a committee appointed by that Association at the Cardiff meeting in 1891.

“The Committee, of which Mr. E. G. Ravenstein was chairman, the late Mr. G. J. Symons, Dr. H. R. Mill and Mr. H. N. Dickson were successively secretaries, Mr. Baldwin Latham and Sir John Kirk original members, prepared a book of instructions for observers, and in other ways promoted the collection of climatological information. After ten years of activity, the Committee ceased its operations, but returns of observations continued to be received, chiefly by the Foreign Office. Some of these were forwarded to Mr. Ravenstein direct and others were placed in charge of the Meteorological Council.”

We rejoice to see a piece of very laborious pioneer work, the initiation of which was due to Mr. Fred. Moir, of Nyasaland, and the burden of which fell mainly on Mr. Ravenstein, taken up by an official body which will secure for it the continuity that can never be attained by individuals upon whose time other matters have prior claims. The portions of tropical Africa dealt with in this report are—The Egyptian Sudan (7 stations), Uganda (8 stations), Congo State (1 station), British East Africa (15 stations), British Central Africa (32 stations), Rhodesia (19 stations), and Portuguese Zambesia (1 station). A valuable bibliography of African tropical climatology concludes the work.

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*Wind Charts for the South Atlantic Ocean.* London: Hydrographic Office. Size, 20 × 27, 12 charts. Price 7s.

A PUBLICATION without a title-page is something of a curiosity in bibliography, but in this instance it is also an important contribution to meteorology. A chart of the South Atlantic with a strip of the South Pacific from the Equator to 65° S. is given for each month of the year. The water-surface is ruled into squares of 5° in the side, and in each square there is a wind-rose showing the average frequency of winds from each point of the compass for that area in that month, based on the observations of a long series of years. Isobars and isotherms are also added. The work was carried out in the Marine Department of the Meteorological Office, and some glimmering of the amount of labour involved and the success achieved may be obtained by the reflection that nearly a million sets of observations have been utilized and so elaborated that the final outcome can be gathered by the eye in half-an-hour without reading a single figure. So notable an achievement deserves to be more fully described than in the scant page of letterpress accompanying the charts.

*The National Physical Laboratory. Report for the year 1903.* London: 1904. Size 10 × 7. Pp. 76. Plates.

THE Report of the National Physical Laboratory for 1903, in addition to the statistics of instruments tested, &c., embodies tabular statements of the meteorological and magnetic observations during the year at Kew Observatory, and the magnetic observations at Falmouth and Valencia, with notes on the work carried out. On the initiative of the Meteorological Office, special observations were made with the Fineman and Strachey nephoscopes in connection with the international scheme of balloon ascents, and some observations of the upper clouds were also made. New earth thermometers were installed at 1 and 4 feet below the surface, and readings were taken three times daily. The rainfall at Kew during 1903 is stated to have been the largest recorded since exact observations began, and 80 per cent. in excess of the average of the preceding 10 years.

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*Physiography: an Introduction to the Study of Nature.* By T. H. HUXLEY, revised and partly re-written by R. A. GREGORY, Professor of Astronomy, Queen's College, London. With 301 illustrations. London: Macmillan & Co., Ltd. 1904. Size 7 × 5. Pp. xii. + 425. Price 4s. 6d.

WHILE the work of an intellectual giant like Huxley must always stand alone when viewed from the point of view of an advanced student, the change of horizon made necessary by the discovery of new facts, and the increased facility of illustration, make it desirable to recast a book of this sort from time to time, if it is to retain its value for the class for which it was originally written. The new book is less impressive in appearance than the old, but the number of its illustrations is a merit, though the scale of some of them is regrettably small. Professor Gregory has done his work well, and has turned out a book such as only an authority on education with a very wide and accurate knowledge of science could produce.

The book keeps prominently before the reader the vital fact of the Earth as a whole, with parts in constant interaction. In reading it, one is reminded how great the whole is which includes the little part, to elucidate which demands the whole attention of a specialist, and it also shows how important the specialist's part is in the grand scheme of the whole. The mutual relations of the Sun, in its actions on the Earth, with air, water and land, are clearly set out. Many of the illustrations are novel and happy, and they are all practical. Few defects have met our eye, though it is offended by the usual typographical contempt for our planet—no editor or printer would write of *the times* as a newspaper, why, we wonder, do they so often refer to *the earth* as a planet. There is one picture which might be

replaced by a better in a new edition. Fig. 56, "Fahrenheit and Centigrade divisions on a simple thermometer," shows 0° C. coincident with 31° F., and 10° C. with 49° F., whereas we all know that the coincidence of 0° C. and 32° F. is essential, and that of 10° C. with 50° F. is a very happy accident. Fig. 57 shows a maximum thermometer graduated down to -25°, while Fig. 58 shows a minimum thermometer graduated only to -10°. This must be rather puzzling for a student, who would naturally expect a minimum thermometer to be able to measure lower temperatures than a maximum.

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*Klimatographie von Oesterreich. I. Klimatographie von Niederösterreich*  
[Climatology of Austria. I. Climatology of Lower Austria],  
von J. HANN. Wien, 1904. Size 11½ × 7½. Pp. 104, and map.  
Price 3 kronen (2s. 6d.)

THIS is the first part of a work on the climate of Austria, published as a memorial of the fiftieth anniversary of the Austrian Central Meteorological Institute. Dr. Pernter, the Director of the Institute, mentions in the preface that the work will consist of sixteen parts, one for each of the crown-lands, and these must necessarily be undertaken by different hands. He invited his predecessor, Hofrat Hann, the leading climatologist in the world, to prepare the first memoir to serve as a pattern on which the others could be fashioned, and the master undertook the work, which is now before us. The province of Lower Austria is treated first as a whole, and then in greater detail for each of the four great divisions. Dr. Hann only claims to give the minimum description possible, merely a statistical skeleton on which an ideal description of the climate might be built up. The ideal referred to would include not only the facts of climate, but the relation of climate to vegetation, agriculture, and mankind; in fact, to the general life of the region in question.

The statistical basis consists of the mean, maximum and minimum of each climatological condition, together with the variability from the mean in successive periods. The barometer is left out of account, as the variations over the small surface of a province are of no direct climatological importance, though it would be considered in a general treatise on the climate of all Austria, after the partial descriptions are completed. Temperature and rainfall are the elements discussed in greatest detail, and the memoir contains a finely-executed rainfall map of Lower Austria, on the scale of about 6 miles to an inch, printed in colours. As Vienna is situated in the province dealt with, it has been possible to compare the records of shorter duration in different places with the very long series available for the capital.

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*Die Anomalien der Witterung auf Island in den Zeitraume 1851 bis 1900 und deren Beziehungen zu den gleichzeitigen Witterungsanomalien in Nordwesteuropa.* von J. HANN. [The anomalies of the weather in Iceland during the period 1851-1900 and their relation to the simultaneous anomalies in North-Western Europe.] From *Sitzungsber. Akad. Wiss. Wien. Math.-Naturwiss. Klasse.* January, 1904. Size  $9\frac{1}{2} \times 6\frac{1}{2}$ . Pp. 88.

A DETAILED discussion of the variations of the monthly values of the various meteorological elements for every year from the fifty years' mean in Iceland, and a comparison with the similar variations in other places. The barometric pressure, temperature and rainfall for 50 years at Stykkisholm, Iceland, are first compared with those at Greenwich, Brussels and Vienna; the pressure at Stykkisholm is then compared with that at Ponta Delgado, both of these being "centres of action," in the terminology of Teisserenc de Bort; the meteorology of Stykkisholm itself is next discussed, and finally the temperature on the east coast of Greenland opposite Stykkisholm.

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*Cape of Good Hope Report of the Meteorological Commission for the year 1902.* Cape Town, 1903. Size  $13 \times 8$ . Pp. 178 and plate.

*An Introduction to the Study of South African Rainfall,* by J. R. SUTTON, M.A. From *Trans. S. African Philos. Soc.* May, 1904. Size  $10 \times 6\frac{1}{2}$ . Pp. 28. Plates.

*A note on the quantities given in Dr. Marloth's paper "On the moisture deposited from the south-east clouds,"* by CHARLES M. STEWART, B.Sc. From *Trans. S. African Philos. Soc.* January, 1904. Size  $10 \times 6\frac{1}{2}$ . Pp. 6.

*Meteorology in South Africa, a retrospect and prospect,* by CHARLES M. STEWART, B.Sc. From *Rep. S. African Assoc.* April, 1903. Size  $9\frac{1}{2} \times 6$ . Pp. 12.

*Cape Town under Water, a series of Realistic Photographs with a complete description of the effects of the Great Storm of June 23rd and 24th, 1904.* Cape Town: Central News Agency. Size  $9\frac{1}{2} \times 12\frac{1}{2}$ . Pp. 16. Price 6d.

WE have had these valuable and interesting publications on our table for months, and the vision of a fitting article to do justice to the efforts now being made in South Africa to improve the study of the weather has flitted before us to the very threshold of that grave of good intentions, a new year. The list of titles would worthily serve as the text for a discourse in a quarterly review, but neither can we find time nor our little monthly space to accomplish our intention. We can only hope that before long some of our South African readers will furnish us with notes of the progress of meteorology in their country, where so much good work is being done.

RAINFALL AND TEMPERATURE, DECEMBER, 1904.

| Div.   | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables in <i>British Rainfall</i> to which each station belongs.] | RAINFALL.   |                             |                       |       |     | Days on which<br>-01 or more fell. | TEMPERATURE. |       |        |       | No. of Nights below 32° |       |
|--------|--------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------|-----------------------|-------|-----|------------------------------------|--------------|-------|--------|-------|-------------------------|-------|
|        |                                                                                                                                      | Total Fall. | Diff. from average, 1890-9. | Greatest in 24 hours. |       |     |                                    | Max.         |       | Min.   |       | Shade                   | Grass |
|        |                                                                                                                                      |             |                             | Depth                 | Date. |     |                                    | Deg.         | Date. | Deg.   | Date. |                         |       |
| I.     | London (Camden Square) ...                                                                                                           | 1·79        | — ·14                       | ·64                   | 6     | 19  | 56·3                               | 29           | 27·6  | 9      | 9     | 19                      |       |
| II.    | Tenterden.....                                                                                                                       | 3·56        | + 1·33                      | ·78                   | 6     | 21  | 55·0                               | 16, 29       | 24·0  | 23     | 8     | 20                      |       |
| „      | Hartley Wintney .....                                                                                                                | 2·39        | + ·25                       | ·55                   | 6     | 21  | 55·0                               | 16           | 25·0  | 9, 21c | 13    | 16                      |       |
| III.   | Hitchin .....                                                                                                                        | 2·12        | + ·18                       | ·50                   | 6     | 15  | 55·0                               | 16           | 21·0  | 21, 22 | 15    | 20                      |       |
| „      | Windsor (Addington) .....                                                                                                            | 1·88        | — ·13                       | ·43                   | 6     | 19  | 56·0                               | 16           | 16·0  | 22     | 13    | 20                      |       |
| IV.    | Bury St. Edmunds (Westley) .....                                                                                                     | 1·80        | — ·31                       | ·44                   | 6     | 21  | 54·8                               | 16           | 20·5  | 20, 23 | ...   | ...                     |       |
| „      | Brundall .....                                                                                                                       | 2·55        | + ·47                       | ·47                   | 6     | 23  | 56·0                               | 16           | 21·0  | 22     | 13    | 24                      |       |
| V.     | Alderbury .....                                                                                                                      | 3·29        | + ·63                       | ·65                   | 10    | 18  | 55·0                               | 17, 30       | 26·0  | 9      | 15    | ...                     |       |
| „      | Winterborne Steepleton ...                                                                                                           | 4·20        | ...                         | ·81                   | 6     | 20  | 53·3                               | 6            | 25·0  | 9      | 6     | 13                      |       |
| „      | Torquay (Cary Green) .....                                                                                                           | 2·74        | ...                         | ·67                   | 8     | 13  | 55·8                               | 16           | 34·1  | 11     | 0     | 9                       |       |
| „      | Polapit Tamar [Launceston]                                                                                                           | 3·75        | + ·09                       | ·47                   | 6     | 23  | 54·0                               | 4, 16a       | 23·5  | 22     | 8     | 12                      |       |
| „      | Bath .....                                                                                                                           | 1·96        | ...                         | ·43                   | 6     | 16  | 56·5                               | 16           | 27·5  | 22     | 11    | 21                      |       |
| VI.    | Stroud (Upfield) .....                                                                                                               | 2·15        | — ·08                       | ·35                   | 6     | 19  | 54·0                               | 17           | 26·0  | 23     | ...   | 12                      |       |
| „      | Church Stretton (Woolstaston)                                                                                                        | 2·53        | — ·02                       | ·70                   | 5     | 20  | 54·0                               | 4            | 19·0  | 23     | 15    | ...                     |       |
| „      | Bromsgrove (Stoke Reformatory)                                                                                                       | 1·75        | + ·02                       | ·40                   | 11    | 16  | 52·0                               | 16           | 21·0  | 22     | 21    | ...                     |       |
| VII.   | Boston .....                                                                                                                         | 1·95        | + ·40                       | ·38                   | 11    | 13  | 55·0                               | 4            | 22·0  | 22     | 19    | ...                     |       |
| „      | Bawtry (Hesley Hall) .....                                                                                                           | 1·19        | — ·67                       | ·32                   | 15    | 11  | 56·0                               | 4            | 16·0  | 22     | 22    | ...                     |       |
| „      | Derby (Midland Railway)...                                                                                                           | 1·39        | — ·47                       | ·23                   | 9, 13 | 18  | 55·0                               | 16           | 20·0  | 22     | 17    | ...                     |       |
| VIII.  | Bolton (The Park) .....                                                                                                              | 3·29        | — ·39                       | ·61                   | 15    | 17  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| IX.    | Wetherby (Ribston Hall) ...                                                                                                          | 1·57        | — ·35                       | ·25                   | 9     | 15  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| „      | Arncliffe Vicarage .....                                                                                                             | 4·58        | — 1·88                      | ·55                   | 15    | 19  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| „      | Hull (Pearson Park) .....                                                                                                            | 1·43        | — ·77                       | ·27                   | 15    | 15  | 55·0                               | 4, 5a        | 23·0  | 23     | 14    | 26                      |       |
| X.     | Newcastle (Town Moor) ...                                                                                                            | 1·94        | — ·49                       | ·69                   | 9     | 13  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| „      | Borrowdale (Seathwaite) ...                                                                                                          | 15·09       | + ·16                       | 2·84                  | 16    | 17  | 54·3                               | 4            | 18·8  | 22, 23 | 18    | ...                     |       |
| XI.    | Cardiff (Ely) .....                                                                                                                  | 3·38        | — ·71                       | ·69                   | 5     | 22  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| „      | Haverfordwest (High St.)..                                                                                                           | 5·14        | + ·43                       | ·74                   | 8     | 21  | 55·1                               | 4            | 27·5  | 24     | 4     | 12                      |       |
| „      | Aberystwith (Gogerddan)..                                                                                                            | 4·77        | + ·22                       | ·92                   | 12    | 16  | 61·0                               | 14           | 20·0  | 23     | 13    | ...                     |       |
| „      | Llandudno .....                                                                                                                      | 3·01        | + ·11                       | ·70                   | 17    | 20  | 60·0                               | 4            | 30·0  | 24     | 5     | ...                     |       |
| XII.   | Cargen [Dumfries] .....                                                                                                              | 3·47        | — 1·25                      | ·75                   | 16    | 13  | 55·0                               | 17           | 22·0  | 27     | 19    | ...                     |       |
| XIII.  | Edinburgh (Royal Observy.)                                                                                                           | 2·40        | ...                         | ·90                   | 12    | 17  | 55·9                               | 17           | 24·2  | 11     | 8     | 18                      |       |
| XIV.   | Colmonell.....                                                                                                                       | 3·72        | — 1·13                      | ·63                   | 11    | 18  | 54·6                               | 14b          | 26·0  | 8      | 10    | ...                     |       |
| XV.    | Tighnabruach .....                                                                                                                   | 6·16        | ...                         | ·80                   | 6     | 17  | 48·0                               | 4, 28        | 22·0  | 10     | 13    | 14                      |       |
| „      | Mull (Quinish).....                                                                                                                  | 4·58        | — 1·67                      | ·71                   | 11    | 22  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| XVI.   | Loch Leven Sluices .....                                                                                                             | 2·08        | — 1·57                      | ·47                   | 15    | 13  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| „      | Dundee (Eastern Necropolis)                                                                                                          | 1·80        | — 1·01                      | ·35                   | 12    | 18  | 56·1                               | 29           | 17·0  | 11     | 12    | ...                     |       |
| XVII.  | Braemar .....                                                                                                                        | 1·87        | — 1·14                      | ·63                   | 4     | 15  | 51·2                               | 5            | 6·0   | 11     | 17    | ...                     |       |
| „      | Aberdeen (Crauford) .....                                                                                                            | 2·80        | — ·18                       | ·70                   | 9     | 19  | 55·0                               | 29           | 10·0  | 10     | 15    | ...                     |       |
| „      | Cawdor (Budgate) .....                                                                                                               | 2·26        | — ·35                       | ·41                   | 29    | 17  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| XVIII. | Glencarron Lodge .....                                                                                                               | 10·73       | + ·30                       | 2·38                  | 29    | 25  | 53·4                               | 5            | 15·6  | 11     | 8     | ...                     |       |
| „      | Bendamph.....                                                                                                                        | 8·73        | — 1·66                      | 1·78                  | 29    | 26  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| XIX.   | Dunrobin Castle.....                                                                                                                 | 2·45        | — 1·01                      | ·70                   | 29    | 12  | 54·0                               | 29           | 23·5  | 11     | 7     | ...                     |       |
| „      | Castletown .....                                                                                                                     | 4·09        | ...                         | 1·30                  | 29    | 24  | 50·0                               | 16, 28       | 20·0  | 10, 11 | 12    | ...                     |       |
| XX.    | Killarney .....                                                                                                                      | 5·01        | — ·77                       | 1·91                  | 17    | 19  | 57·0                               | 20           | 27·5  | 8      | ...   | ...                     |       |
| „      | Waterford (Brook Lodge)...                                                                                                           | 3·76        | — ·11                       | ·62                   | 8     | 20  | 54·0                               | 4            | 23·0  | 11     | 6     | ...                     |       |
| „      | Broadford (Hurdlestown) ...                                                                                                          | 3·36        | + ·10                       | ·58                   | 16    | 23  | 54·0                               | 23           | 26·0  | 7      | 9     | ...                     |       |
| XXI.   | Carlow (Browne's Hill) .....                                                                                                         | 2·09        | — 1·29                      | ·33                   | 8     | 19  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| „      | Dublin (FitzWilliam Square)                                                                                                          | 1·50        | — ·85                       | ·44                   | 9     | 17  | 59·0                               | 4            | 28·2  | 22     | 5     | 13                      |       |
| XXII.  | Ballinasloe .....                                                                                                                    | 3·48        | — ·11                       | ·75                   | 16    | 24  | 64·0?                              | 4            | 23·0  | 8      | 13    | ...                     |       |
| „      | Clifden (Kylemore House)..                                                                                                           | ...         | ...                         | ...                   | ...   | ... | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| XXIII. | Seaforde .....                                                                                                                       | 2·46        | — ·97                       | ·51                   | 9     | 17  | 54·0                               | 4, 16        | 27·0  | 10d    | 9     | 16                      |       |
| „      | Londonderry (Creggan Res.)                                                                                                           | 3·06        | — 1·06                      | ·56                   | 4     | 21  | ...                                | ...          | ...   | ...    | ...   | ...                     |       |
| „      | Omagh (Edenfel).....                                                                                                                 | 2·85        | — 1·09                      | ·50                   | 16    | 21  | 54·0                               | 4            | 25·0  | 8      | 11    | 27                      |       |

+ Shows that the fall was above the average ; that it was below it. a—and 17. b—and 15, 16. c—and 22, 23. d—and 11, 18.

## SUPPLEMENTARY RAINFALL, DECEMBER, 1904.

| Div.  | STATION.                             | Rain.<br>inches | Div.   | STATION.                          | Rain.<br>inches |
|-------|--------------------------------------|-----------------|--------|-----------------------------------|-----------------|
| II.   | Dorking, Abinger Hall .....          | 3·33            | XI.    | New Radnor, Ednol .....           | 3·21            |
| „     | Sheppey, Leysdown .....              | 1·93            | „      | Rhayader, Nantgwilt .....         | 5·14            |
| „     | Hailsham .....                       | 3·19            | „      | Lake Vyrnwy .....                 | 5·08            |
| „     | Crowborough .....                    | 4·43            | „      | Ruthin, Plás Drâw .....           | 3·19            |
| „     | Ryde, Beldornie Tower .....          | 3·20            | „      | Criccieth, Talarvor .....         | 3·97            |
| „     | Einsworth, Redlands .....            | 3·42            | „      | Anglesey, Lligwy .....            | 2·59            |
| „     | Alton, Ashdell .....                 | 3·48            | „      | Douglas, Woodville .....          | 3·25            |
| „     | Newbury, Welford Park .....          | 2·43            | XII.   | Stoneykirk, Ardwell House .....   | 2·80            |
| III.  | Harrow Weald .....                   | 2·14            | „      | Dalry, Old Garroch .....          | 5·85            |
| „     | Oxford, Magdalen College .....       | 1·78            | „      | Langholm, Drove Road .....        | 4·55            |
| „     | Banbury, Bloxham .....               | 1·56            | „      | Moniaive, Maxwellton House .....  | 4·37            |
| „     | Pitsford, Sedgebrook .....           | 1·65            | „      | Lilliesleaf, Riddell .....        | 2·18            |
| „     | Huntingdon, Brampton .....           | 1·78            | XIII.  | N. Esk Reservoir [Penicuik] ..... | 3·60            |
| „     | Wisbech, Bank House .....            | 1·65            | XIV.   | Maybole, Knockdon Farm .....      | 3·04            |
| IV.   | Southend .....                       | 1·45            | „      | Glasgow, Queen's Park .....       | 3·41            |
| „     | Colchester, Lexden .....             | 1·91            | XV.    | Inveraray, Newtown .....          | 7·92            |
| „     | Saffron Waldon, Newport .....        | 2·01            | „      | Ballachulish, Ardsheal .....      | 9·99            |
| „     | Rendlesham Hall .....                | 2·16            | „      | Campbeltown, Redknowe .....       | 4·66            |
| „     | Swaffham .....                       | 1·48            | „      | Islay, Eallabus .....             | 4·20            |
| „     | Blakeney .....                       | 1·87            | XVI.   | Dollar .....                      | 5·55            |
| V.    | Bishop's Cannings .....              | 2·53            | „      | Balquhider, Stronvar .....        | 9·51            |
| „     | Ashburton, Druid House .....         | 4·71            | „      | Coupar Angus Station .....        | 2·16            |
| „     | Okehampton, Oaklands .....           | 4·47            | „      | Blair Atholl .....                | 3·33            |
| „     | Hartland Abbey .....                 | 3·23            | „      | Montrose, Sunnyside .....         | 2·01            |
| „     | Lynmouth, Rock House .....           | 3·32            | XVII.  | Alford, Lynturk Manse .....       | 2·38            |
| „     | Probus, Lamellyn .....               | 4·46            | „      | Keith, H.R.S. .....               | 3·72            |
| „     | Wellington, The Avenue .....         | 2·55            | XVIII. | Fearn, Lower Pitkerrie .....      | 1·96            |
| „     | North Cadbury Rectory .....          | 3·27            | „      | S. Uist, Askernish .....          | ...             |
| VI.   | Clifton, Pembroke Road .....         | 2·32            | „      | Invergarry .....                  | 6·66            |
| „     | Moreton-in-Marsh, Longboro' .....    | 2·16            | „      | Aviemore, Alvie Manse .....       | 3·13            |
| „     | Ross, The Graig .....                | 2·19            | „      | Loch Ness, Drumnadrochit .....    | 3·78            |
| „     | Shifnal, Hatton Grange .....         | 1·86            | XIX.   | Invershin .....                   | 2·78            |
| „     | Wem Rectory .....                    | 1·60            | „      | Altnaharra .....                  | 5·79            |
| „     | Cheadle, The Heath House .....       | 1·89            | „      | Bettyhill .....                   | 3·76            |
| „     | Coventry, Kingswood .....            | 1·97            | „      | Watten, H.R.S. .....              | 2·46            |
| VII.  | Market Overton .....                 | 1·67            | XX.    | Cork, Wellesley Terrace .....     | 2·76            |
| „     | Market Rasen .....                   | 1·76            | „      | Darrynane Abbey .....             | 4·21            |
| „     | Worksop, Hodsock Priory .....        | 1·20            | „      | Glenam [Clonmel] .....            | 2·96            |
| VIII. | Neston, Hinderton .....              | 2·38            | „      | Ballingarry, Hazelfort .....      | 2·14            |
| „     | Southport, Hesketh Park .....        | 2·38            | „      | Miltown Malbay .....              | 4·20            |
| „     | Chatburn, Middlewood .....           | 3·22            | XXI.   | Gorey, Courtown House .....       | 2·53            |
| „     | Duddon Valley, Seathwaite Vic. ..... | 7·54            | „      | Moynalty, Westland .....          | 2·55            |
| IX.   | Langsett Moor, Up. Midhope .....     | 3·30            | „      | Athtone, Twyford .....            | 2·65            |
| „     | Baldersby .....                      | 2·02            | „      | Mullingar, Belvedere .....        | 2·23            |
| „     | Scalby, Silverdale .....             | 2·68            | XXII.  | Woodlawn .....                    | 3·87            |
| „     | Ingleby Greenhow .....               | 3·37            | „      | Westport, Murrisk Abbey .....     | 3·75            |
| „     | Middleton, Mickleton .....           | 1·83            | „      | Crossmolina, Enniscoo .....       | 4·82            |
| X.    | Beltingham .....                     | 1·88            | „      | Collooney, Markree Obsy .....     | 3·76            |
| „     | Bamburgh .....                       | 1·34            | XXIII. | Enniskillen, Portora .....        | ...             |
| „     | Keswick, The Bank .....              | 6·73            | „      | Warrenpoint .....                 | 2·22            |
| „     | Melmerby Rectory .....               | 3·23            | „      | Banbridge, Milltown .....         | 1·85            |
| XI.   | Llanfrechfa Grange .....             | 3·43            | „      | Belfast, Springfield .....        | 2·95            |
| „     | Tranherbert, Tyn-y-waun .....        | 8·45            | „      | Bushmills, Dundarave .....        | 3·27            |
| „     | Llandoverly, Tonn .....              | 3·87            | „      | Stewartstown .....                | 2·53            |
| „     | Castle Malgwyn .....                 | 5·08            | „      | Killybegs .....                   | 4·39            |
| „     | Llandefaelog-fach .....              | ...             | „      | Horn Head .....                   | 4·00            |

## METEOROLOGICAL NOTES ON DECEMBER, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

## ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A mild, gloomy and depressing month, with great absence of sunshine and much damp, foggy weather. From the morning of the 19th till about 11 a.m. on 23rd, London was continuously developed in more or less dense fog. A westerly gale on 30th did considerable damage. Duration of sunshine 15·3\* hours, and of R 39·6 hours. Mean temp. 41°·0, or 1°·8 above the average. The total duration of rainfall for the year was 492 hours on 160 days, and of bright sunshine 1,252 hours on 256 days.

TENTERDEN.—Very wet from 4th to 14th, but dry in the latter half, and beautiful from 19th to 22nd. Violent W. to N.W. gale on 30th. Duration of sunshine 48·2† hours.

CROWBOROUGH.—Wet and mild, escaping much of the fog experienced elsewhere. Mean temp. 41°·5.

HARTLEY WINTNEY.—Cold, damp and gloomy, with great lack of sunshine. Frost and R alternated during the first fortnight, in the latter raw, penetrating fog prevailed, lasting 10 days. Ozone on 12 days, with a mean of 5·0.

BRUNDALL.—Un genial, with much R followed by fogs. Great wind storm on 30th, doing much damage. Mean temp. 39°·4, or 0°·9 above the average.

TORQUAY.—R 1·16 in. below the average. Duration of sunshine 53·4\* hours, or 0·1 hour above the average. Mean temp. 46°·6, or 3°·1 above the average. Mean amount of ozone 4·8.

WELLINGTON.—The first 15 days had R, but not in large quantities; the latter part was generally dry, but with dense fog at times before Christmas.

NORTH CADBURY.—Very humid and cloudy, but warm and exceedingly calm.

CLIFTON.—R every day till 17th, with short fine intervals. An anti-cyclone then set in, bringing after one clear day dull, raw and foggy weather, with easterly winds changing to S.W. on 27th with a great increase of temp. S.W. to W. gale on the night of 29th. R one inch below the average.

ROSS.—R daily from 2nd to 17th, with max. temp. above 50° on 10 days. From 19th to 28th was raw, cold and unpleasant, with continual fog. No severe frost, but much low temp.

WOOLSTASTON.—Exceedingly variable temp., with S on five days. Dense fog from 22nd to 25th. Tremendous gale on 29th and 30th.

WORKSOP.—Changeable, with a good deal of slight frost, but no severe cold. Much fog about Christmas.

SOUTHPORT.—Mild and unusually sunny until 8th, and then cold, calm and remarkably foggy till 28th. Mean temp. 0°·4 below the average. Duration of sunshine 13 hours above the average. R ·69 in. below the average. Under-ground water level exceptionally low.

LLANFRECHFA GRANGE.—Mild till 22nd, when sharp frost set in for 2 days, and much thick fog in the latter part. Heavy gale on the night of the 29th.

HAVERFORDWEST.—Wet, stormy and mild till 17th, after which a dry period set in with considerable fall in temp., and much fog and gloom. Sudden N.W. gale on the night of the 29th. Duration of sunshine 27·6\* hours on 13 days.

DOUGLAS.—An open month, with many beautiful days. Some S fell on 7th. Gloomy from 19th to 27th, but no real fog. Gales on 6 days, that on 29th, occurring with high bar., being exceptionally severe.

## SCOTLAND.

LANGHOLM —R 1·07 in. below the average of 28 years. Several gales, the most severe being from N.W. on the night of the 29th.

\* Campbell-Stokes.

† Jordan.

MAXWELTON HOUSE.—Very fine, with some high winds, but mostly quite calm or with light breezes. Farmers quite contented.

COUPAR ANGUS.—Mean temp. 35°·2, or practically the average of 25 years. Cold snap during the second week, the min. reaching 8° on 11th, but the duration of the cold weather was short, and it did not affect the mean much. R slightly below the average.

DRUMNADROCHIT.—R 1·49 in. below, and rainy days 3 above, 18 years' average.

WATTEN.—The first half was stormy, with R and S; then ten days of fresh, open, calm and mild weather, and at the close stormy with heavy R and gale.

CASTLETOWN.—The first part was very wet, with S from 6th to 11th. The latter part was damp and overcast. Strong northerly gale on 30th.

IRELAND.

CORK.—R 1·69 in. below the average. Gales on 4th and 8th, and a storm on 16th and 17th. Prevailing winds S.E. and E. Dense fog on 2nd.

DARRYNANE.—Very mild, with some fine spring-like days. The last 10 days were foggy. R 73 per cent. of the average of 20 years.

WATERFORD.—A long spell of easterly winds at the end, and a good deal of fog. Mean temp. 43°·1.

MILTOWN MALBAY.—The first half was cold, with much R and H and some S, with squalls and boisterous winds. Mild and dry in the second half.

MARKREE OBSERVATORY.—On the whole exceptionally fine and mild, though the first part was rather wet.

BELFAST.—Frost in the first half, followed by very dull foggy weather. The finest December since 1890.

OMAGH.—Rainy and unsettled up to 19th. Remainder mild, stagnant and hazy with but little rain except on the last three days.

THE TWELVE MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—December, 1904. (See p. 221.)

| Stations.             | Total Rain. | Per cent. of Aver. | Stations.           | Total Rain. | Per cent. of Aver. | Stations.         | Total Rain. | Per cent. of Aver. |
|-----------------------|-------------|--------------------|---------------------|-------------|--------------------|-------------------|-------------|--------------------|
|                       | in.         |                    |                     | in.         |                    |                   | in.         |                    |
| London .....          | 20·65       | 91                 | Arncliffe .....     | 56·31       | 91                 | Braemar .....     | 25·00       | 72                 |
| Tenterden .....       | 25·22       | 96                 | Hull .....          | 21·25       | 85                 | Aberdeen .....    | 26·13       | 82                 |
| Hartley Wintney ..... | 23·88       | 95                 | Newcastle.....      | 23·43       | 90                 | Cawdor .....      | 22·68       | 75                 |
| Hitchin .....         | 21·65       | 93                 | Seathwaite .....    | 130·04      | 97                 | Glencarron .....  | 89·55       | 95                 |
| Winslow .....         | 22·36       | 94                 | Cardiff .....       | 43·26       | 109                | Dunrobin .....    | 27·56       | 89                 |
| Westley .....         | 20·69       | 82                 | Haverfordwest ..... | 42·96       | 99                 | Killarney .....   | 51·12       | 93                 |
| Brundall .....        | 21·50       | 86                 | Gogerdan .....      | 44·83       | 100                | Waterford .....   | 41·12       | 107                |
| Alderbury .....       | 27·53       | 100                | Llandudno .....     | 25·98       | 85                 | Broadford .....   | 38·74       | 116                |
| Ashburton .....       | 50·26       | 101                | Dumfries .....      | 38·91       | 89                 | Carlow .....      | 32·06       | 95                 |
| Polapt Tamar .....    | 43·35       | 118                | Lilliesleaf .....   | 27·75       | 92                 | Dublin .....      | 22·19       | 81                 |
| Stroud .....          | 26·79       | 100                | Colmonell .....     | 43·22       | 99                 | Mullingar .....   | 33·90       | 107                |
| Woolstaston .....     | 26·66       | 92                 | Glasgow .....       | 34·65       | 95                 | Ballinasloe ..... | 39·27       | 107                |
| Boston .....          | 20·32       | 101                | Inveraray .....     | 70·65       | 98                 | Clifden .....     | ...         | ...                |
| Hesley Hall .....     | 19·37       | 91                 | Islay .....         | 51·73       | 111                | Crossmolina ..... | 59·72       | 114                |
| Derby .....           | 19·91       | 88                 | Mull .....          | 57·95       | 103                | Seaforde .....    | 33·97       | 94                 |
| Bolton .....          | 34·74       | 84                 | Loch Leven .....    | 31·88       | 89                 | Londonderry..     | 41·74       | 101                |
| Wetherby .....        | 25·61       | 108                | Dundee .....        | 24·70       | 90                 | Omagh .....       | 42·89       | 108                |

## Climatological Table for the British Empire, July, 1904.

| STATIONS.<br><br><i>(Those in italics are South of the Equator.)</i> | Absolute. |       |          |                 | Average. |      |            |           | Absolute.    |                | Total Rain. |       | Aver.<br>Cloud. |
|----------------------------------------------------------------------|-----------|-------|----------|-----------------|----------|------|------------|-----------|--------------|----------------|-------------|-------|-----------------|
|                                                                      | Maximum.  |       | Minimum. |                 | Max.     | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth.      | Days. |                 |
|                                                                      | Temp.     | Date. | Temp.    | Date.           |          |      |            |           |              |                |             |       |                 |
| London, Camden Square                                                | 88·9      | 17    | 49·7     | 4               | 77·7     | 56·4 | 57·9       | 76        | 133·2        | 45·2           | 2·41        | 10    | 5·0             |
| Malta                                                                | ...       | ...   | ...      | ...             | ...      | ...  | ...        | ...       | ...          | ...            | ...         | ...   | ...             |
| <i>Cape Town</i>                                                     | 81·2      | 31    | 36·9     | 21              | 64·3     | 48·9 | 49·6       | 79        | ...          | ...            | 2·47        | 9     | 4·6             |
| <i>Durban, Natal</i>                                                 | 80·3      | 14    | 49·3     | 23              | 74·0     | 54·5 | ...        | ...       | 127·3        | ...            | 1·89        | 7     | 2·0             |
| <i>Johannesburg</i>                                                  | 67·0      | 10    | 34·0     | 26              | 60·2     | 42·4 | 31·4       | 50        | ...          | 28·5           | ·02         | 1     | 6·0             |
| <i>Mauritius</i>                                                     | 76·2      | 22    | 51·3     | 30              | 74·1     | 59·4 | 59·0       | 77        | 138·6        | 43·4           | 2·09        | 18    | 5·2             |
| Calcutta                                                             | 93·2      | 12    | 75·0     | 7               | 87·1     | 78·3 | 77·1       | 87        | 153·8        | 73·9           | 20·62       | 17    | 8·7             |
| Bombay                                                               | 87·3      | 1     | 75·3     | 5               | 85·4     | 78·1 | 76·4       | 83        | 134·2        | 74·0           | 10·14       | 25    | 8·5             |
| Madras                                                               | 101·0     | 7     | 73·3     | 25              | 96·0     | 77·9 | 70·9       | 67        | 144·6        | 72·0           | 6·18        | 18    | 6·5             |
| Kodaikanal                                                           | 65·6      | 27    | 49·6     | 19 <sup>a</sup> | 61·7     | 51·7 | 51·0       | 84        | 146·2        | 45·2           | 4·27        | 21    | 2·4             |
| Colombo, Ceylon                                                      | 85·2      | 24    | 71·8     | 5               | 83·6     | 76·2 | 72·9       | 83        | 146·0        | 70·0           | 8·94        | 19    | 8·1             |
| Hongkong                                                             | 90·0      | 29    | 74·2     | 2               | 85·9     | 77·9 | 75·2       | 82        | 149·6        | ...            | 7·23        | 17    | 7·6             |
| <i>Melbourne</i>                                                     | 64·4      | 23    | 31·5     | 23              | 63·1     | 31·5 | 42·8       | 83        | 117·8        | 26·6           | 1·57        | 12    | 6·4             |
| <i>Adelaide</i>                                                      | 62·6      | 25    | 36·9     | 29              | 58·1     | 44·8 | 44·9       | 81        | 120·3        | 30·8           | 2·73        | 15    | 5·8             |
| <i>Coolgardie</i>                                                    | 67·2      | 4     | 32·0     | 14              | 58·6     | 41·2 | 40·4       | 70        | 136·9        | 23·5           | 1·90        | 8     | 5·8             |
| <i>Sydney</i>                                                        | 67·7      | 14    | 40·7     | 19              | 58·2     | 47·6 | 44·1       | 82        | 99·0         | 32·9           | 11·06       | 21    | 5·9             |
| <i>Wellington</i>                                                    | 57·9      | 20    | 32·0     | 3               | 51·7     | 41·5 | 40·6       | 79        | 97·0         | 29·0           | 4·29        | 15    | 7·6             |
| <i>Auckland</i>                                                      | 61·0      | 11    | 37·0     | 23              | 56·7     | 49·9 | 44·9       | 80        | 115·0        | 33·0           | 2·24        | 11    | 5·0             |
| Jamaica, Negril Point.                                               | 89·9      | 8     | 69·7     | 25              | 86·7     | 72·2 | 72·7       | 77        | ...          | ...            | 6·91        | 9     | ...             |
| Trinidad                                                             | ...       | ...   | ...      | ...             | ...      | ...  | ...        | ...       | ...          | ...            | ...         | ...   | ...             |
| Grenada                                                              | 85·8      | 25    | 68·8     | 11              | 82·0     | 74·3 | 70·1       | 75        | 147·2        | ...            | 8·71        | 28    | 4·5             |
| Toronto                                                              | 92·0      | 18    | 48·1     | 3               | 76·4     | 58·2 | 59·2       | 76        | 121·7        | 41·5           | 5·13        | 11    | 5·2             |
| Fredericton                                                          | 86·1      | 20    | 45·0     | 4               | 79·2     | 56·5 | 60·3       | 61        | ...          | ...            | 1·48        | 7     | 6·2             |
| Winnipeg                                                             | 85·2      | 16    | 42·5     | 1               | 74·4     | 52·2 | ...        | ...       | ...          | ...            | 5·55        | 15    | 5·0             |
| Victoria, B.C.                                                       | 82·3      | 21    | 49·0     | 14              | 68·9     | 52·7 | ...        | ...       | ...          | ...            | ·48         | 5     | 3·8             |
| Dawson                                                               | 75·0      | 18    | 39·0     | 25              | 69·0     | 46·2 | ...        | ...       | ...          | ...            | 2·14        | 10    | 5·1             |

a and 26.

*Mauritius*.—Mean temp. of air 1°·2, dew point 0°·4, and rainfall 11 in., below averages. Mean hourly velocity of wind 9·8 miles, or 2·1 miles below average.

MADRAS.—Bright sunshine 136·7 hours, or 34·6 per cent. of possible. TS on 5 days.

KODAIKANAL.—Bright sunshine 116 hours.

COLOMBO.—Mean temp. of air 79°·2, or 1°·5 below, of dew point 0°·4 below, R 4·46 in. above, averages. Mean hourly velocity of wind 9·9 miles; prevailing direction S.W.

HONGKONG.—Mean temp. of air 81°·1. Sunshine 147·4 hours. Mean hourly velocity of wind 10·9 miles; direction S.S.W.

*Adelaide*.—Mean temp. of air 51°·4. R 19 in. above average.

*Sydney*.—Mean temp. of air 0°·6 above, R 6·31 in. above, and humidity 5·2 per cent. above, averages.

*Wellington*.—Mean temp. of air 1°·0 below, and R 1·57 in. below, averages.

*Auckland*.—Mean temp. of air close to average, and R less than half the average of previous 36 years.