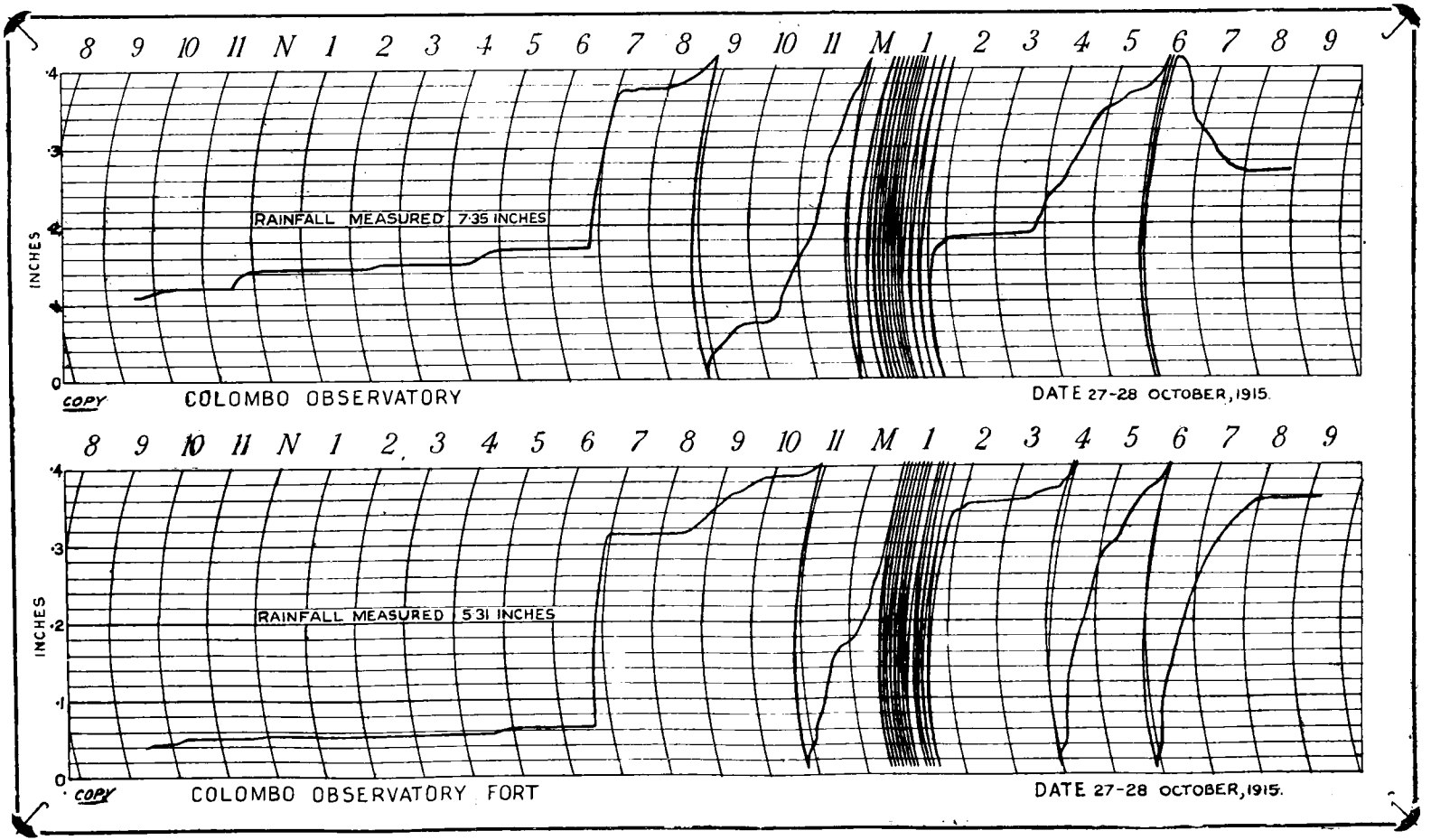
INTENSE RAINFALLS AT COLOMBO, CEYLON.



SYMONS'S

METEOROLOGICAL

MAGAZINE

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

VOLUME THE FIFTIETH

1915

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INTRODUCTORY TO OUR FIFTIETH VOLUME.

On February 16th, 1866, the first eight-page number of this Magazine appeared, not as a new creation, but as the natural evolution of the four-page Monthly Rain Circular, which, in 1865, had developed from the two-page Rain Circular first issued by George James Symons as a one-page circular, in 1863. The essential feature of the Magazine of 1915 as of the Rain Circular of 1863, is the Table of Rainfall of the preceding month, showing the total fall with the difference from the average, at a number of stations in the British Isles. Mr. Symons originally intended the publication to be the monthly organ of the British Rainfall Organization, the annual publication of which had, by 1866 grown from his four-page quarto pamphlet; "English Rainfall, 1860," to a little octavo volume of 116 pages, which was also published, it is curious to note, on February 16. The Magazine has remained in large degree, supplementary to the annual volume of *British Rainfall* Mr. Symons, however, intended it from the first to have a wider scope, and in particular to record the proceedings of Meteorological Societies, to notice new books on Meteorological subjects, and to form a record of meteorological progress and a channel of communication between workers. These aims have been consistently held in view, though their development has always been retarded by the pressure of financial considerations; yet this pressure which limited expansion to the surplus resources of the Rainfall Organization after the publication of *British Rainfall*, has lead this little Magazine to its present great age.

We term it a great age advisedly, for none of the several monthly meteorological magazines which have sprung up in Europe or America during the last hundred years, have even approximated to its length of life, although many of them have far exceeded our issues both in size and in scientific value, while they lasted. We can look back on a tranquil and regular life of steady, though

restricted expansion in size and circulation, and of regular appearance in spite of difficulties which more than once might have justified the quick and easy solution of cessation. If in weathering these crises the number of our pages has occasionally shrunk, and now and then the scope has been narrowed, to the recording of the small beer of meteorological observing, the crises have hitherto been tided over and progress has been accelerated after them. This, we are moderately confident, will be the case with the greatest crisis of all through which we, in common with all the world, are now passing.

If we are right in interpreting and endeavouring to carry out the views of our distinguished founder, the Magazine should help to extend the usefulness of the Rainfall Organization by presenting rainfall work in its proper subordination to general Meteorology, and should stimulate Observers who may not, to begin with, have more than a casual or curious interest in reading rain records, to take larger views and follow the great advances of the science of the atmosphere. In this task we have been aided to an extent for which we are most grateful, not only by hundreds of keen Observers, but by dozens of the most eminent men of science who have devoted themselves to abstruse and profound studies of the physics of the atmosphere, and we acknowledge very gratefully the generous recognition and encouragement they have given us. We have always given prominence to the climatology of our own country—the United Kingdom first and the British Empire next—but we have received no less kindness from the meteorologists of other countries than from those of our own. At this time, when it is as fashionable to ridicule and decry all things German as it was to ridicule and decry all things pertaining to other nations a century or sixty years ago, we feel it to be a matter of scientific duty to acknowledge our equal indebtedness in the past fifty years to all these nations. Whatever may be the opinion of some men of science as to the inferiority of Germans in their particular studies, we and our readers cannot fail to remember how much we owe to German and Austrian meteorologists. While we yield to no one in our detestation of the war which Germany and Austria-Hungary have forced upon the world, or in our determination to do all that is possible to defeat the aggressions and ambitions of these governments, we cannot be so false to our own consistency as to stigmatise as poor or contemptible those vast and noble acquisitions to knowledge made in the last half century by those Germans, whom, up to last summer, all our learned societies delighted to honour. Although for the present we carry on our work without the aid of the subjects of enemy-empires, we trust that our pages in years to come will once again rejoice in the brotherhood of the men of science of a re-made Europe and a world at peace. The air still serenely laps our planet undisturbed by the

stained and strained political map beneath it, but the study of its universal law depending on the interchange of observations and the simultaneous execution of experiments has, for the moment, stopped, and when resumed there will be a gap that can never be bridged. As regards the Observers, with whose work we are more intimately associated, it is possible to find even now that the effects of the war have not all been of a detrimental nature. Although few of the 5,500 voluntary Observers can have reached the end of 1914 without some sorrow or loss or dislocation of the affairs of life due to the war, the returns of rainfall have been sent in by an earlier date than in any recent year. This is a straw that shows how the wind of public feeling blows, and it is no contemptible little army of Observers which can steady itself thus in the discharge of a commonplace peaceful routine under the fire of such a kindling of national enthusiasm for war as has never been known before.

In the remarks on the returns received from the area within sound of the German bombardment of the north-east coast, the only reference to the occurrence was this memorandum by the Observer at Filey : " Please note that no rain fell here when German guns fired so heavily at Scarborough."

Weather conditions have never before been so important in the life of the country as during the last six months, and so far as rainfall is concerned there were some unusually interesting points. The unprecedented wetness of December in the Southern Counties attracted the more attention because of the dryness of the autumn, and in all circumstances sharply contrasted spells of weather near the end of a year have been found to stimulate interest in recording and to enlarge the number of Observers in the following year. This fact no doubt accounts in part for the alacrity we have referred to, but we are satisfied that the more potent reason was the general quickening of mental processes due to the intellectual upturning produced by the war.

It must be a matter of pride to all British meteorologists, as it may well be a thing of wonder to the rest of the world, that at the Annual Meeting of the Royal Meteorological Society, reported in these pages, the retiring President, returned on short leave from the front, where he had been in charge of a motor ambulance, handed over the Chair to the new President, who had snatched an hour from his military duties with the Royal Engineers in order to show his appreciation of the abiding value of science.

REMARKS ON SNOWFALL STUDY, (GEOGRAPHICAL DISTRIBUTION).

By L. C. W. BONACINA.

I HAVE often thought that the Observers of the British Rainfall Organization could supply the material for a neglected but most interesting study, were they to keep a record of the aggregate depth of snow which falls annually in their respective localities. In so damp a climate as ours it would not always be possible to measure the exact number of inches of undrifted snow which has fallen *as* snow; but extreme accuracy would not be necessary in such an investigation, provided that in course of time the data gave a general idea of the approximate average monthly and annual depths of snow in different parts of the country. I might, perhaps, stimulate interest in the subject by making a few observations on the apparent distribution of snow in this country.

It has always seemed to me that the snowfall of Great Britain as a whole, though very irregular, is great, but that the undoubted rarity of deep snow in the metropolitan area has tended to produce a different impression. To speak only of the lowlands, there appears to be a far greater difference in the average snowfall between the northern and southern counties of England than the comparatively small difference of latitude alone would account for, especially in view of the fact that there is very little difference in the mean temperature of the air—at least at the coldest time of the year. The discrepancy, I think, is only explicable by reference to the much greater extent of elevated land in the north, which itself naturally receiving a big snowfall, has the effect of increasing the fall in the adjacent lowlands, by a process mainly thermal but possibly also mechanically connected with the little understood laws of crystallization of aqueous vapour from the atmosphere. When, for example, there are large quantities of falling or fallen snow over the bleak Pennine Chain, the air in the adjacent plains of Lancashire and Yorkshire will be so chilled as to cause a precipitation to fall as snow, which in the south is falling as rain. But in addition to this purely thermal effect, it is not impossible that the pressure of a central core of falling snow with freezing temperature over the Pennines may tend mechanically to bring down snow over a peripheral lowland region where the temperature may be in the dubious zone for rain or snow. Be that as it may, however, I think the big snowfalls of Manchester, Sheffield, and Leeds have some connection with neighbouring high ground.

To turn now to the west country; many a Cornishman has assured me that there is not usually much snow his side of Plymouth, but in the same breath he has never failed to impress upon me the memorable occasion in the spring of 1891, when you might walk over the hedge-tops without knowing it (provided, I suppose, you

did not sink). The fury of this great blizzard of March 9th to 13th, 1891, has probably never been surpassed in the United Kingdom, and it ranks in the annals of the west of England as more famous even, than that of January, 1881, in the south, so often quoted by Londoners.

To come to the south-eastern corner of England, the more eastern parts of Kent seem to suffer somewhat unduly from snow, not only in winter, but often very late in the spring—about April; but certain information as to how the Dover coast compares with other districts in the south of England can only be gleaned on the co-operative lines I have suggested above. As a rule the last place ever to get snow is London, and the reason is evidently to be found in the vast artificially warm town area, since snow in this country usually occurs at the upper temperature limit, which in town is thus often exceeded. The present January has furnished the first real snowfall in London since the fine falls early in March, 1909. Notwithstanding the scarcity of snow in London of recent years, the municipal authorities generally seem to expect a big dose, to judge from the lavish display of posters advertising for able-bodied men in case of eventualities. I might add, in this connection, that one sultry day last July, as I was toiling along the dusty high-road between Putney and Kingston, longing to turn in at Robin Hood Gate to see the great trees in Richmond Park once more, I was both amazed and amused to find a refreshing souvenir of the previous winter stuck in a poster on the side of a dust-bin by the road-side, and headed "Metropolitan Borough of Wandsworth: Snowstorms."

ROYAL METEOROLOGICAL SOCIETY.

THE annual General Meeting of the Society was held on January 20th, at the Surveyors' Institution, Westminster, Mr. C. J. P. Cave, President, in the Chair.

In the report for the year 1914 the Council noted a slight increase in the number of Fellows, the total number on December 31st, being 729. Acknowledgment was made of the services of Dr. H. N. Dickson, as Acting-President during the President's absence in France with the Red Cross Society. Upper Air researches had been continued, Mr. Gold having carried out a series of observations during a voyage to Australia. At the instance of the Aeronautical Society a Joint Committee had been appointed to initiate and promote means for utilizing the special knowledge of each Society for advancing the science of both. The preparation of a Climatological Atlas of the British Isles had been continued in co-operation with the Meteorological Office, and the work

relating to barometric pressure and wind was almost complete. Provisional maps showing the amounts of cloud had been prepared and the material for maps of sunshine was being collated by the Meteorological Office. Dr. H. R. Mill had undertaken to co-operate by the preparation of rainfall maps.

Votes of thanks were accorded the Council for their work during the year, and the Institution of Civil Engineers and Surveyors' Institution, for the use of their rooms. On the motion of Dr. C. Chree, seconded by Mr. W. W. Bryant, a hearty vote of thanks was given to Mr. C. J. P. Cave, the retiring President, for the manner in which he had directed the work of the Society during two years of office. Mr. Bryant remarked on the noteworthy coincidence that both the retiring President and his successor appeared in khaki.

The following officers were elected for the ensuing session. *President:* Capt. H. G. Lyons, D.Sc., F.R.S.; *Vice-Presidents:* Mr. C. J. P. Cave, Mr. E. Gold, Mr. Baldwin Latham, C.E., Mr. Carle Salter; *Treasurer:* Mr. F. Druce; *Secretaries:* Mr. F. Campbell Bayard, Capt. W. F. Caborne, C.B.; *Foreign Secretary:* Dr. R. H. Scott, F.R.S.; *Councillors:* Mr. W. W. Bryant, Dr. C. Chree, F.R.S., Dr. H. N. Dickson, Messrs., J. S. Dines, R. H. Hooker, A. P. Jenkin, R. G. K. Lempfert, Lt.-Col. H. Mellish, Sir J. W. Moore, M.D., D.Sc., Col. H. E. Rawson, C.B., Capt. A. Simpson, Capt. D. Wilson-Barker.

Capt. Lyons, on taking the chair, said that if the present time was one of stress and difficulty, it was one in which meteorology was surely coming to its own. Aircraft and naval flotillas owed much to meteorology, and he urged the Society to endeavour to promote the science now that it was so much to the front. He added that he would do all in his power to uphold the dignity of the office to which he had succeeded, and hoped that the Society's meetings would maintain the high standard reached under Mr. Cave's presidency.

At the Ordinary Meeting, which followed, the members of the Committee engaged in the preparation of the Climatological Atlas, gave an account of the work so far accomplished. Dr. H. N. Dickson, chairman of the Committee, dealt with the difficulties in regard to publication at the present time. It had been decided to issue the Atlas in two volumes, the first comprising maps of barometric pressure, wind, sunshine, and cloud; the second, temperature, relative humidity, and rainfall. The data upon which the work was based was for the 40 years, 1871 to 1910. Lt.-Col. Mellish described the preparation of the maps of cloud amounts. He much regretted that practically all the observations were taken at 9 a.m., an hour which had been recently shown to be undesirable, owing to frequent atmospheric changes at this time of day. Mr. Gold, dealing with barometric pressure, doubted if 40 years was

a sufficiently long period from which to deduce normal values. He was led to this belief by the results of an analysis of the long records existing at Gordon Castle, Edinburgh, and London. Mr. Lempfert, dealing with the wind, said that maps of frequency had been prepared for each month, and for each quarter of the compass. The effect of orographical features was apparent in the results for many stations, and the difference between summer and winter was also made clear. Work was now being done on wind velocity and the results would be shown in the form of wind roses. The sunshine results would shortly be completed and would appear as an appendix.

Mr. J. H. Wilson was elected a Fellow of the Society. At the December meeting the following gentlemen were elected Fellows: Mr. G. A. C. de Boinville, Dr. J. Brownlee, Mr. C. E. Evans, Mr. C. M. G. Hoyte, Capt. T. Robertson.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

SEASONAL LIMITS.

WHILST quite agreeing with Mr. Brodie (Vol. **49**, p. 182), that the present Meteorological Seasonal Limits lead to some misconceptions as to weather in the various quarters, may I venture to suggest a much more simple way of surmounting the difficulty than that which he proposes? It appears to me that if Meteorologists were to adopt the Astronomical divisions of the year, the troubles stated by your correspondent would practically disappear. Autumn weather is finished with by December 21st, Winter conditions seldom if ever occur later than March 21st. Spring frosts have been known to occur as late as June 13th (1911), but never later than the 21st of that month, whilst only on one occasion has a really great "heat wave" taken place in the past 30 years, later than September 23rd. Now if Mr. Brodie's suggestion were adopted Spring would end in the middle of May. Being an amateur gardener of some little experience I know that some of the worst "May frosts" are apt to occur *after* the 15th of the month, and have frequently had my bedding-plants "blackened" by disregarding the advice of my gardener not to put anything delicate out of doors until after the 20th May. Mr. Brodie would put these late May frosts, then, down to Summer and not to Spring. Is this quite right to Summer? If the Astronomical Seasons were followed by Meteorologists all these minor difficulties would vanish, and we should still have the year practically divisible by four.

D. W. HORNER, F.R.S.A., F.R.Met.Soc.

"The Chestnuts," Mangersbury, Stow-on-the-Wold, Gloucester, December 5th, 1914.

RE-ARRANGEMENT OF THE SEASONS.

I DO not agree with Mr. Bonacina that the length of day and steepness of ray have much to do with this matter. The chief factors are *mean* and *extreme* temperatures. Notwithstanding the duration of daylight and the approximate verticality of the solar beams in May, that month is unquestionably in Spring (except, perhaps, the last week or ten days), and the period is often chilly and sometimes very frosty in the small hours. As to February, that time of the year has provided us with two months (1855 and 1895), of almost unparalleled severity, to say nothing of others also very cold. Obviously that month is *not* in Spring, though its daylight is greater than that of November. As to bursts of very mild weather in February, it should be noted that we experience them at times in every winter month, even as far north as Wick. I have sometimes thought that these high Scotch temperatures may be due to a kind of *föhn* wind crossing the Highlands. Some of the most *lovely* sunny weather occurs in November, as I know from an experience of nearly seventy years.

August is often spoken of as an Autumn month, on the strength of the harvest; but wheat-ears, botanically, are "fruit," quite as much as cherries, raspberries, etc., which belong to the Summer. August is clearly a Summer month, though Mr. Bonacina calls it "already Autumn." All fruit months (June to September) may be regarded as Summer. The time of the golden and fast-dropping leaf is Autumn.

It will be found that length of day and approach to verticality of ray cannot be happily wedded to temperature, the ripening of crops, and much of the labour of the husbandman.

Too much importance must not be given to the appearance of flowers. The primrose, lesser periwinkle, snowdrop, hazel, elm, daffodil, crocus, dog-mercury, etc., are *hyemal* as well as vernal.

E. G. ALDRIDGE.

Bideford, 22nd January, 1915.

THE SNOWFALL, JANUARY 22nd.

SNOW commenced to fall about 6 a.m., and continued more or less until nearly 7 p.m. It was 12 inches deep at 2 p.m., and every tree and shrub was deeply covered, presenting a very beautiful sight. The damage the snow did to trees, shrubs, and telephone wires was remarkable. The newspapers reported rain in the city, but none fell here, though a rapid thaw set in at night. My rain gauge yielded 1·20 in. snow water.

G. E. DACEY.

65, *Clarendon Road, Lewisham, S.E.*

THE FLOODING OF SALISBURY CATHEDRAL.

I SEND you, as a memento of the Salisbury floods of the 5th and 6th January, a photograph taken by me on the 6th, of the interior of the Cathedral. As you will see by the photograph, the water was very clear, the flood being caused by spring water, which came

up all over the nave, between the stones of the pavement. We had here, from October 13th to December 31st, 1914, 16·86 in. of rain, and of this 2·93 in. fell in the last seven days of December, and on the top of this came 2·06 in. for the first three days of the present month. GEORGE KNOWLES.

Stockton, Codford St. Mary, Wilts, 24th January, 1915.

OUR ANNUAL DEW DEPOSIT, AND HORARY TEMPERATURE.

UPWARDS of seventeen months ago, to wit, 31st July, 1913, you were good enough to refer me to certain works on dew formation, as bearing on the method of investigation I was employing in examining into that matter. Since then I have been carefully and diligently pursuing the subject in the way described on p. 163 of Vol. 48, *Symons's Meteorological Magazine*, and the results for last year and the previous one are now analysed out. But they are remarkably small. One wonders how and where those who pose as authorities get their information. With the exercise of the utmost generosity I could not allow to the year 1913 a more ample deposit of dew here than the equivalent of 0·75 in. rainfall; and last year I got decidedly less, 0·316 in., in fact. In both cases about 55 per cent. of the total seems to have been precipitated from the atmosphere, and 45 per cent. exhaled by grass and soil. Now it seems reasonable to assume that dew is deposited in some parts of Great Britain much more liberally than in others; also that there is a considerable variation in the amount at any one place from year to year. Would it not be possible to organise a scheme for the systematic investigation of this matter in the British Islands? From time to time we meet with the statement of a credited authority on such subject—and that to the effect that the average value of the annual dew deposit in this country is five inches. Such seems to me a gross exaggeration; but one feels he would like to know what led to such estimate, whether correct or not.

During the last two years, also, I have been interested to note what one might term the horary value of fluctuations in temperature, by means of a thermograph. It seems to me if this sort of thing were done generally throughout Great Britain a far more striking record of annual variation would be obtained than by carefully noting the annual "mean" here and there. I append the figures so obtained for the years 1913—1914.

	1913.	1914.
Hours with temp. below 32 deg. ..	110	61
,, ,, 32 to 40 deg. ..	780	986
,, ,, 40 to 50 deg. ..	2,590	2,438·5
,, ,, 50 to 60 deg. ..	3,086	2,921·5
,, ,, 60 to 70 deg. ..	1,785	1,715·5
,, ,, 70 to 80 deg. ..	351	547
,, ,, 80 to 90 deg. ..	58	87
Higher than 90 deg.	0	3·5

WILLIAM GODDEN.

Richmond Avenue, Willesden, 17th January, 1915.

RAPID RISE IN A CHALK WELL.

I THINK the records given below of the rainfall adjacent to, and the depth to the water in, a well sunk in the Chalk from a point 480 ft. above Ordnance Datum, at the head of the Wandle Gathering Ground at Chelsham, Surrey, will be of interest to your readers.

Date	SEPTEMBER. Depth to Water from Surface. ft.	SEPTEMBER. Daily Rainfall. in.	OCTOBER. Depth to Water from Surface. ft.	OCTOBER. Daily Rainfall. in.	NOVEMBER. Depth to Water from Surface. ft.	NOVEMBER. Daily Rainfall. in.	DECEMBER. Depth to Water from Surface. ft.	DECEMBER. Daily Rainfall. in.
1...			183·0			·02	208·0	
2...			183·0		190·0	·19	208·0	·24
3...			189·0		195·0		208·0	
4...					195·0	·26	208·0	·30
5...			180·0		195·0	·04	208·0	
6...			181·0		196·0	·02	208·0	·20
7...			181·0		200·0		208·0	·11
8...		·04	181·0				208·0	·06
9...		·03	185·0		192·0		208·0	1·51
10...		·10	187·0		199·0	·02	208·0	·03
11...	176·0	·16			206·0	·19	199·0	·28
12...	176·0	·15	183·0	·01	206·0	·02	191·0	·52
13...		·13	187·0	·06	206·0	·09	181·0	·95
14...	176·0		187·0	·40	206·0	·06	167·0	·44
15...	176·0		187·0	·01		1·16	156·0	·04
16...	176·0	·05	187·0		190·0		148·0	
17...	177·0	·03	188·0		198·0		142·0	·15
18...	177·0				202·0		137·0	·37
19...	177·0	·01			206·0	·25	134·0	·22
20...		·03		·02	207·0			·09
21...	177·0				207·0		129·0	·05
22...	178·0			·11			127·0	
23...	178·0			·02	196·0		125·0	·03
24...	179·0			·01	200·0	·10	124·0	
25...	179·0			·33	206·0		123·0	
26...	179·0		188·0	·06	207·0	·23	122·0	·73
27...			192·0	·01	208·0	·05		·29
28...	179·0		192·0	·07	208·0	·35	121·0	·64
29...	183·0		192·0	·47	208·0	·23	121·0	
30...	183·0		193·0	·07	208·0	·57	118·0	·26
31...			193·0				118·0	·04
		0·73		1·65		3·85		7·55

It will be seen that the rainfall for the three autumn months, September, October, and November, was very low, and that the water in the well reached its maximum depth from the surface on the 27th November, and remained at that depth till December 10th. The rise was then remarkably rapid. By the next morning it had risen 9 feet, by the 17th 66 feet, and by the end of the month 90 feet. Since it began on December 10th, the rise has amounted to the date of this letter, to 126 feet. These facts presage an early breaking out of the Bourne, in the Kenley Valley, if it has not already occurred.

W. VAUX GRAHAM.

5, *Queen Anne's Gate, Westminster. S.W., January 25th,* 1913.

REMARKABLE SNOWFALL AT BORDEN WOOD, LIPHOOK.

On the 22nd of January snow began to fall at daybreak and continued throughout the day, and it still snowed at 11 p.m. The snow was of a very heavy, moist character, and from about 4 o'clock rain fell also. At 2 p.m. the depth of snow was 6 inches, at 11 p.m., 8 inches. On the following morning, 23rd, the surface of the snow was frozen, the grass minimum thermometer registered 31 degrees, the rain gauge recorded 1·30 in. The snow lay till 31st. Absolute calm prevailed during the snowfall, and afterwards, owing to this fact, the snow remained on everything on which it fell, evergreen trees and shrubs were borne to the ground, as also were dense twigged deciduous trees as birch, willow, etc., causing many branches to splinter and break off. Astonishing as it may seem, many stout limbs of oak gave way under the great strain and snapped off. As illustrating the calm which prevailed and the clinging nature of the snow on this occasion, it was interesting to note that on a horizontal wire stretched in the open (gauge 14) at noon, the snow stood 3 inches high, soon after 4 p.m. some 4 inches were suspended from the wire and about 1 inch remained on top.

Borden Wood, Liphook. E. J. PLATT.

REVIEWS.

Water Supplies, Their Purification, Filtration, and Sterilisation. A handbook for the use of Local and Municipal Authorities. By Samuel Rideal, D.Sc., and Eric K. Rideal, B.A., Ph.D. With numerous illustrations and tables. London, Crosby, Lockwood and Son, 1914. Size 9 × 5½. Pp. xxii. + 274.

Dr. Samuel Rideal, as the result of long experience in chemistry applied to the purification of water, speaks with a voice of high authority on all matters connected with the detection and elimination of impurities from the most necessary of all commodities. He does not deal, except in passing, with the meteorological, geological, or engineering aspects of water supply, but concentrates his attention upon sources of contamination and methods of purification. The treatment throughout is designed for the local official desirous of understanding the modern methods of chemical and bacteriological treatment of water supplies. The general reader will learn with some surprise how complicated is the process necessary to restore purity to the rain drops contaminated by their contact with air and earth, and the method by which the aid of beneficent bacteria is invoked against disease-producing organisms. Features of the book are the bibliography appended to each chapter, and the illustrations of methods of filtration, sterilisation, and other processes.

INTERNATIONAL BALLOON ASCENTS.

By W. H. DINES, F.R.S.

December 6th, 1911.

Starting Point.	Country.	A (Hc) miles	B (Tc) ° F.	C miles.	D ° F.	E miles.	F
Pyrton Hill.....	England ..	5·5	—60	8·6	—62	35	E.N.E.
,, 3.15 p.m.	,, ..	6·0	—63	8·8	—69	57	S.E. by E.
Brussels	Belgium ..	6·4	—74	14·3	?	70	E.N.E.
Hamburg	Germany..	6·6	—81	6·9	—69	72	N.E.
Paris.....	France....	5·8	—75	8·4	—69	75	N.E.
Strassburg	Germany..	6·6	—79	7·7	—69	41	N.E.
Munich	,, ..	7·4	—78	9·1	—69	27	N.E.
Vienna.....	Austria....	5·9	—78	7·3	—67	27	E.N.E.
Pavia	Italy	7·0	—80	13·5	?	29	N.N.E.
Pavlowsk.....	Russia	5·5	—54	11·3	—71	66	N. by W.

December 7th, 1911.

Brussels	Belgium ..	5·8	—79	8·0	—75	30	N.E.
Hamburg.....	Germany..	6·1	—76	9·9	?	80	E.
Lindenberg.....	,,	5·6	—71	8·6	?	43	N.E.
Paris.....	France....	6·1	—74	7·1	—78	100	N.N.E.
Strassburg.....	Germany..	6·7	—72	7·1	—71	29	E.N.E.
Zurich	Switzerland	6·8	—76	9·5	—73	..	..
Munich	Germany..	5·8	—62	5·9	—62	39	N.E.
Vienna.....	Austria ..	5·9	—78	7·2	—67	46	N.E. by E.
Pavia	Italy	7·7	—67	?	..	24	N.E.
Pavlowsk.....	Russia	6·0	—69	9·6	—65	61	E. by N.

December 8th, 1911.

Manchester	England ..	5·6	—63	11·0	—71	52	E.
Brussels	Belgium ..	8·0	—59	12·5	—58	37	E.S.E.
Lindenberg	Germany..	6·4	—83	7·9	—64	58	N.N.E.
Paris	France....	7·0	—69	11·0	?	319	S.E. by E.
Strassburg	Germany..	6·0	—58	8·5	—65	50	N.E.
Munich	,, ..	6·9	—76	7·3	—74	56	N.N.E.
Vienna.....	Austria ..	5·8	—80	7·1	—70	28	N.E.
Pavlowsk.....	Russia	6·4	—74	9·8	—65	14	N. by E.

A Height in miles of commencement of isothermal column.
B Temperature, F°., at bottom of column.
C Greatest height of reliable record in miles.
D Temperature, F°., at greatest height.
E Distance in miles of point where balloon fell
F Bearing of falling point from starting point

During the three days the barometer was very high over northern Russia, but very rapid and irregular changes were shown over

Central Europe. On the 6th a low pressure lay over Iceland and a high pressure over the Bay of Biscay, on the 7th the depression was approaching Scotland, and on the 8th had reached the North Sea. The maximum height given for Pavia on the 7th is 23 miles, with an air pressure of 3mm., *i.e.*, ·12 inches of mercury pressure. This means that the balloon expanded to more than six times its diameter at starting, and there must certainly be some mistake.

THE RAINFALL IN CUBA AND IN ENGLAND, SOUTH-WEST.

By A. Hampton Brown.

In a recent enquiry dealing with the connection between the rainfall in Cuba and that recorded subsequently in England, south-west, it was pointed out that when the "rainy" season at Havana, which extends from May to October, is characterised by excessive precipitation, then the months of January to March following, in England, south-west, are more or less dry. The converse also held good. On the average of the 36 years, 1877-1912, the correlation co-efficient worked out at —·54 with a probable error of ·08. The figures for 1914 have now come to hand, and the total rainfall for the wet season at Havana reaches only 71 per cent of the average fall, and indicates that in the south-west of England precipitation for the early part of the year 1915 should be abundant. In view, however, of the heavy rains of the last few weeks of 1914, one's faith in the strength of the correlation is somewhat shaken, for wet periods of from five to six months in this country, are by no means common. In 1911, the rainfall at Havana during the wet season amounted to only 66 per cent. of the average, and that recorded in England, south-west, during January to March, 1912, reached the high figure of 146 per cent. And this followed a remarkably wet October—December, the rainfall for the same district being 130 per cent. of the average. On the other hand, during the wet season at Havana in 1912, 108 per cent. of the mean rainfall was registered, which implied a deficient fall in our south-west districts in January—March, 1913, but the percentage worked out at 139 per cent. The previous three months, October—December, had also been wet (109 per cent).

Whether it is possible in this country to make any practical use of correlations, or whether it is wiser to wait until a more scientific method of long-date forecasting has been established, the reader must decide for himself. The figures given above may help him in his decision, and assist him in speculating on the probable rainfall for the coming three months. The percentages for England, south-west, mentioned above, refer to district 8 of the *Weekly Weather Report* stations of the Meteorological Office.

METEOROLOGICAL NEWS AND NOTES.

MR. JAMES S. HARDING, who died on January 11th, was one of the last links with the earliest days of the Meteorological Office. Mr. Harding was Private Secretary to Admiral FitzRoy in 1854, when the Office was a Department of the Board of Trade. He retired in 1906 after a service of more than half a century, during the greater part of which he acted as Chief Clerk to the Meteorological Council. He had been a fellow of the Royal Meteorological Society since 1866 and had made valuable contributions to the work of the Society. He was an accomplished linguist and gave much time to the study of International meteorology. Of a kindly and courteous disposition he was held in high esteem by all who knew him, and was the recipient of a handsome presentation from his colleagues in the Meteorological Office on the occasion of his retirement. Mr. Harding frequently contributed to the pages of this Magazine in earlier years.

FLOODS of a disastrous nature took place at Los Angeles, California, as a consequence of exceptional rainfall on February 18th–21st, 1914. During these four days the amount recorded varied from 2·03 in. at San Pedro on the coast, to 19·40 in. at Mount Wilson, and 19·20 in. at Mount Lowe, about 30 miles north. At Mount Lowe, at an elevation of 3420 feet, the annual average rainfall is only 26 inches, so that during the four days about three-quarters of a normal year's rain fell. Dr. Ford A. Carpenter, in an address to the American Society of Civil Engineers, has given particulars of a large number of floods during the last 37 years, only 9 years having been free from floods. The majority of these have taken place after the second of two successive heavy rains. The most serious was in 1884, and in 1889 no fewer than five floods were experienced.

ERRORS DUE TO UNUSUAL UNITS are always difficult to detect until writers grow accustomed to the unfamiliar appearances of the quantities dealt with. Similar difficulties arise in the hasty reading of statistics grouped in a new way, an interesting example of which is found in the statement, which has appeared in many newspapers, that 4·19 in. of rain fell in five minutes at Oklahoma in June, 1913. As a matter of fact the fall on this occasion was only 0·13 in., but the table containing the information gave accumulated rainfall at 5-minute intervals, hence the mistake. Professor Alexander McAdie, writing from the Blue Hill Observatory to *Nature* of October, 1914, explained how the mistake arose and expressed a hope that the correction might receive wide publicity as the error had found its way even into so critical a journal as the *Meteorologische Zeitschrift.*

RAINFALL TABLE FOR JANUARY, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	1·83	4·12
Tenterden	*Kent*	51 4	*0 41	190	2·14	3·22
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·59	5·05
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·75	4·18
Oxford (Magdalen College).	*Oxfordshire*	51 45	1 15	186	1·78	2·84
Wellingborough(Swanspool)	*Northampton*	52 18	0 41	155	1·90	2·51
Shoeburyness	*Essex*	51 31	*0 48	13	1·33	1·96
Bury St. Edmunds(Westley)	*Suffolk*	52 15	*0 40	226	1·70	2·70
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	1·53	3·38
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	3·59	5·10
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·94	3·56
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·33	2·98
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·51	5·08
Boston	*Lincolnshire*	52 58	0 1	11	1·54	2·55
Worksop (Hodsock Priory).	*Nottinghamshire*	53 22	1 5	56	1·70	2·15
Mickleover Manor	*Derbyshire*	52 54	1 32	280	1·95	2·76
Macclesfield	*Cheshire*	53 15	2 7	501	2·66	5·69
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	2·55	3·98
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	6·26	9·72
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	1·89	3·42
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	1·70	2·84
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	1·90	2·12
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	13·44	16·79
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	3·65	4·10
Haverfordwest	*Pembroke*	51 48	4 58	90	4·69	4·30
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	3·91	6·71
Llandudno	*Carnarvon*	53 20	3 50	72	2·51	3·57
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·10	3·53
Marchmont House	*Berwick*	55 44	2 24	498	2·40	2·28
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	4·78	6·55
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·53	2·31
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	7·34	7·72
Mull (Quinish)	,,	56 34	6 13	35	5·55	8·16
Dundee(EasternNecropolis)	*Forfar*	56 28	2 57	199	2·01	1·94
Braemar	*Aberdeen*	57 0	3 24	1114	2·92	3·48
Aberdeen (Cranford)	,,	57 8	2 7	120	2·36	3·42
Gordon Castle	*Moray*	57 37	3 5	107	1·99	2·47
FortAugustus(S.Benedict's)	*E. Inverness*	57 9	4 41	68	5·58	4·31
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	9·42	10·82
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·75	...
Wick	*Caithness*	58 26	3 6	77	2·48	2·15
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	5·94	5·41
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	3·78	2·29
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·88	5·27
Ennistymon House	*Clare*	52 57	9 18	37	4·30	6·93
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·19	2·40
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·15	3·65
Dublin(FitzWilliamSquare)	*Dublin*	53 21	6 14	54	2·14	2·10
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·10	5·27
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	5·35	6·78
Cong (The Glebe)	,,	53 33	9 16	112	4·79	6·32
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·87	5·69
Seaforde	*Down*	54 19	5 50	180	3·41	2·60
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·19	2·62
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·46	4·49

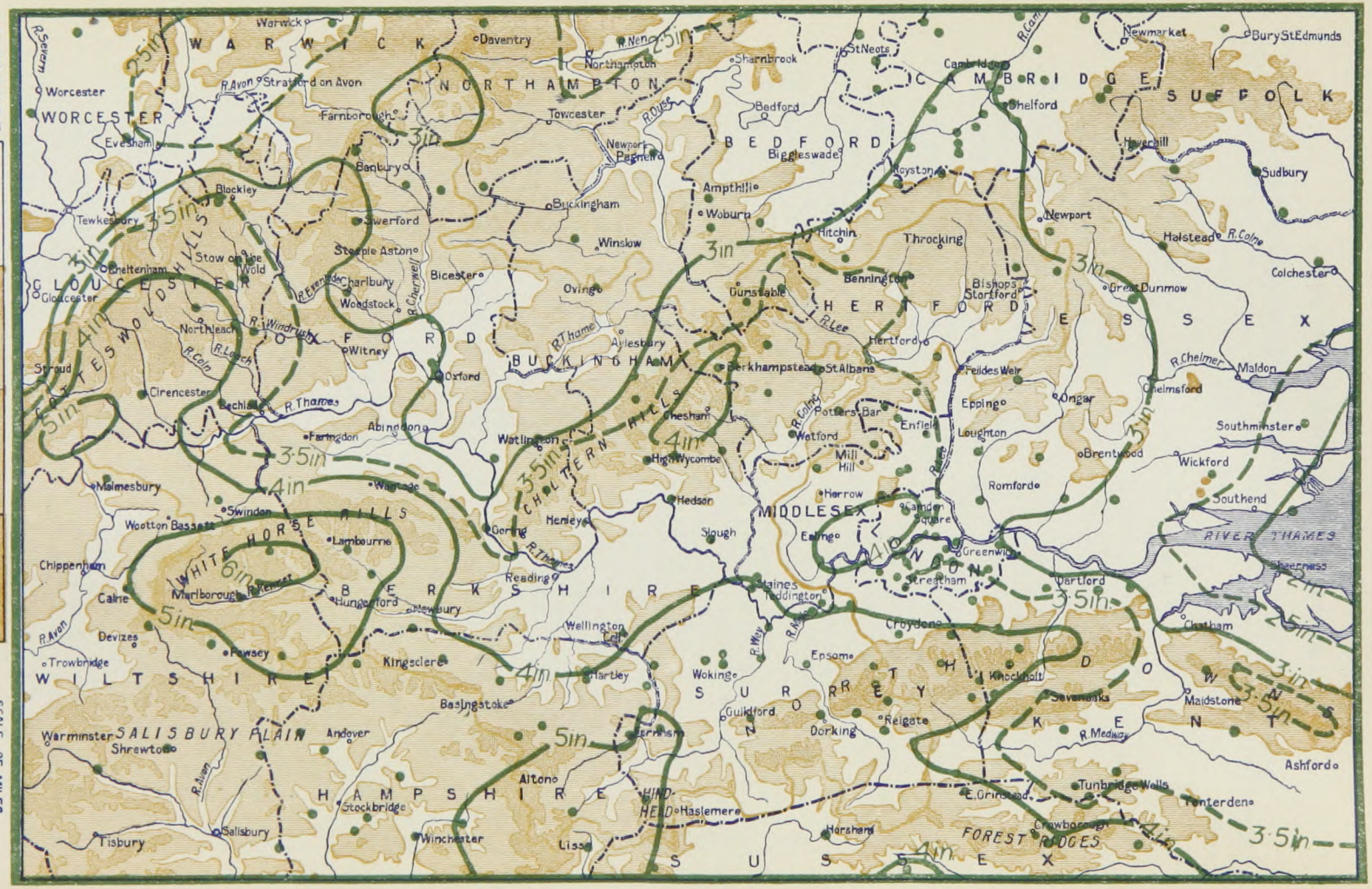
RAINFALL TABLE FOR JANUARY, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875—1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
+2·29	225	·93	22	19	...	...	...	...	25·11	Camden Square
+1·08	150	·60	1	21	...	...	...	...	27·64	Tenterden
+2·46	195	·96	6	23	...	...	...	...	30·48	Patching
+1·43	152	·90	3	21	...	...	...	...	31·87	Cadland
+1·06	160	·79	3	19	...	...	...	...	24·58	Oxford
+ ·61	132	·48	1	18	...	...	...	...	25·20	Swanspool
+ ·63	147	·27	7	23	..	...	...	...	19·28	Shoeburyness
+1·00	159	·34	10	20	...	...	...	...	25·40	Westley
+1·85	221	·52	21	28	...	...	...	...	23·73	Geldeston
+1·51	142	·77	20	26	...	...	...	...	38·27	Polapit Tamar
+ ·62	121	·95	6	20	...	...	...	...	33·54	Rousdon
+ ·65	128	·66	3	18	...	...	...	...	29·81	Stroud
+2·57	202	·92	3	19	...	...	...	...	32·41	Wolstaston
+1·01	166	·24	1, 3	25	...	...	...	...	23·35	Boston
+ ·45	127	·52	3	20	...	...	...	..	24·46	Hodsock Priory
+ ·81	142	·57	4	22	...	...	...	...	26·65	Mickleover
+3·03	214	·72	7	21	...	...	...	...	34·73	Macclesfield
+1·43	156	·83	7	18	...	...	...	...	32·70	Southport
+3·46	156	2·13	15	19	...	...	...	...	61·49	Arncliffe
+1·53	181	·88	3	13	...	...	...	...	26·87	Ribston Hall
+1·14	167	·62	3	29	...	...	...	...	26·42	Hull
+ ·22	112	·52	3	25	...	...	...	...	27·94	Newcastle
+3·35	125	2·20	15	20	...	...	...	...	129·48	Seathwaite
+ ·45	112	·47	1	25	...	...	...	...	42·28	Cardiff
— ·39	92	·74	20	18	...	...	...	...	46·81	Haverfordwest
+2·80	172	·85	20	21	...	...	...	...	45·46	Gogerddan
+1·06	142	·76	7	15	...	...	...	...	30·36	Llandudno
— ·57	86	·75	10	16	...	...	...	...	43·47	Cargen
— ·12	95	·35	3	17	...	...	...	...	33·76	Marchmont
+1·77	137	1·25	30	21	...	...	...	...	49·77	Girvan
—1·22	65	·38	14	16	...	...	..	...	35·97	Glasgow
+ ·38	105	1·16	14	20	...	...	...	...	68·67	Inveraray
+2·61	147	1·02	6	24	...	...	...	...	56·57	Quinish
— ·07	97	·39	4	14	...	...	...	...	28·64	Dundee
+ ·56	119	1·30	1	15	...	...	...	...	34·93	Braemar
+1·06	145	·56	12	20	...	...	...	...	32·73	Aberdeen
+ ·48	124	·63	12	19	...	...	...	...	30·34	Gordon Castle
—1·27	77	·70	14	19	...	...	...	...	44·53	Fort Augustus
+1·40	115	1·20	14	20	...	...	...	...	83·93	Bendamph
...	...	...	...	...	...	...	...	...	31·90	Dunrobin Castle
— ·33	87	...	...	...	...	...	...	...	29·88	Wick
— ·53	91	·55	4	27	...	...	...	...	54·81	Killarney
—1·49	61	·23	15	21	...	...	...	...	39·57	Waterford
+1·39	136	·86	1	22	...	...	...	...	39·43	Castle Lough
+2·63	161	·61	1	27	...	...	...	...	46·52	Ennistymon'
— ·79	75	·36	15	13	...	...	...	...	34·99	Courtown Ho.
+ ·50	116	·53	1	20	...	...	...	...	35·92	Abbey Leix
— ·04	98	·35	1	18	...	...	...	...	27·68	Dublin
+2·17	170	·85	10	26	...	...	...	...	36·15	Mullingar
+1·43	127	1·28	15	26	...	...	...	...	52·87	Enniscoe
+1·53	132	1·01	15	25	...	...	...	...	48·90	Cong
+1·82	147	·86	15	26	...	...	...	...	42·71	Markree
— ·81	76	·59	15	19	...	...	...	...	38·91	Seaforde
— ·57	82	·34	10	20	...	...	...	...	37·56	Dundarave
+1·03	130	·69	15	26	...	...	...	...	39·38	Omagh

SUPPLEMENTARY RAINFALL, JANUARY, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	5·00	XI.	Lligwy	4·07
,,	Ramsgate	2·81	,,	Douglas	3·63
,,	Hailsham	4·55	XII.	Stoneykirk, Ardwell House...	2·68
,,	Totland Bay, Aston House...	3·53	,,	Carsphairn Shiel	7·89
,,	Stockbridge, Ashley..	4·34	,,	Beattock, Kinnelhead	4·71
,,	Grayshott	5·26	,,	Langholm, Drove Road	3.14
III.	Harrow Weald, Hill House...	3·68	XIII.	Meggat Water, Cramilt Lodge	2·96
,,	Caversham, Rectory Road ...	3·63	,,	North Berwick Reservoir	1·71
,,	Pitsford, Sedgebrook...	2·39	,,	Edinburgh, Royal Observaty.	1·22
,,	Woburn, Milton Bryant	2·93	XIV.	Maybole, Knockdon Farm ...	4·00
,,	Chatteris, The Priory	2·42	XV.	Ballachulish House	11·11
IV.	Elsenham, Gaunts End	3·08	,,	Campbeltown, Witchburn ..	4·11
,,	Colchester, Hill Ho., Lexden	2·65	,,	Holy Loch, Ardnadam	6·70
,,	Ipswich, Rookwood, Copdock	2·66	,,	Islay, Eallabus	4·92
,,	Blakeney	3·18	,,	Tiree, Cornaigmore	5·43
,,	Swaffham	2·72	XVI.	Dollar Academy	2·78
V.	Bishops Cannings	4·68	,,	Balquhidder, Stronvar	6·19
,,	Wimborne, St. John's Hill ...	3·52	,,	Glenlyon, Meggernie Castle..	6·34
,,	Ashburton, Druid House..	4·97	,,	Blair Atholl	3·93
,,	Cullompton	4·72	,,	Coupar Angus	2·04
,,	Lynmouth, Rock House ..	4·79	,,	Montrose, Sunnyside Asylum.	2·63
,,	Okehampton, Oaklands. .	6·18	XVII.	Alford, Lynturk Manse	3·56
,,	Hartland Abbey	2·71	,,	Fyvie Castle	4·70
,,	Probus, Lamellyn	4·51	,,	Keith Station ..	4·16
,,	North Cadbury Rectory	3·71	XVIII.	Rothiemurchus	2·65
VI.	Clifton, Pembroke Road	3·73	,,	Loch Quoich, Loan	22·70
,,	Ross, The Graig	3·05	,,	Drumnadrochit	2·85
,,	Shifnal, Hatton Grange.	3·20	,,	Skye, Dunvegan	7·56
,,	Droitwich	2·69	,,	Lochmaddy, Bayhead	4·48
,,	Blockley, Upton Wold	3·55	,,	Glencarron Lodge	11·40
VII.	Market Overton	2·65	XIX.	Invershin	1·93
,,	Market Rasen	2·36	,,	Melvich	2·52
,,	Bawtry, Hesley Hall	1·96	,,	Loch Stack, Achfary	9·03
,,	Derby, Midland Railway	2·60	XX.	Dunmanway, The Rectory ..	6·73
,,	Buxton	8·47	,,	Glanmire, Lota Lodge	2·87
VIII.	Nantwich, Dorfold Hall	3·84	,,	Mitchelstown Castle	3·81
,,	Chatburn, Middlewood	6·17	,,	Darrynane Abbey	6·42
,,	Lancaster, Strathspey	5·35	,,	Clonmel, Bruce Villa	2·59
IX.	Langsett Moor, Up. Midhope	6·67	,,	Newmarket-on-Fergus, Fenloe	5·22
,,	Scarborough, Scalby	4·94	XXI.	Laragh, Glendalough	5·11
,,	Ingleby Greenhow	3·97	,,	Ballycumber, Moorock Lodge	4·21
,,	Mickleton	4·60	,,	Balbriggan, Ardgillan	2·00
X.	Bellingham, High Green Manor	2·36	XXII.	Woodlawn	4·75
,,	Ilderton, Lilburn Cottage ...	2·21	,,	Ballynahinch Castle	7·40
,,	Keswick, The Bank	5·75	,,	Westport, St. Helens	6·06
XI.	Llanfrechfa Grange	3·75	,,	Dugort, Slievemore Hotel ...	8·28
,,	Treherbert, Tyn-y-waun	8·68	,,	Mohill Rectory	4·10
,,	Carmarthen, The Friary	4·72	XXIII.	Enniskillen, Portora	5·14
,,	Fishguard Goodwick Station.	3·57	,,	Dartrey [Cootehill]	3·47
,,	Crickhowell, Tal-y-maes	4·50	,,	Warrenpoint, Manor House ..	2·65
,,	New Radnor, Ednol	2·00	,,	Banbridge, Milltown	2.37
,,	Birmingham WW., Tyrmynydd	8·65	,,	Belfast, Cave Hill Road	4.19
,,	Lake Vyrnwy	5·02	,,	Ballymena Harryville	4·39
,,	Llangynhafal, Plâs Draw	3·39	,,	Londonderry, Creggan Res...	4·43
,,	Dolgelly, Bryntirion	8·09	,,	Dunfanaghy, Horn Head ...	4·72
,,	Bettws-y-Coed, Tyn-y-bryn...	8·76	,,	Killybegs	7·83

THAMES VALLEY RAINFALL. —— JANUARY, 1915.



THE WEATHER OF JANUARY.

Owing to the influence of a deep barometric depression in the west, rough weather prevailed generally at the beginning of the month. Southerly gales were experienced in Ireland and along the west coast of Great Britain on the 1st. At Warrenpoint, where the gale was very severe, the sea wall and roadway were carried away in several places. Heavy rain fell daily in almost all parts of the Kingdom, and on the 3rd snow or sleet fell at many stations in the south of England. On this day the fall measured 2·30 in. at Mildenhall, 2·11 in. at Wexcombe, and more than 1·00 in. over the upper Thames Valley. About 1·00 in. of rain fell at most stations in Devon and Cornwall on the 6th. The floods in the Thames Valley, the most serious since November 1894, reached their height at the beginning of the second week. Large areas were under water, in places to a depth of over two feet, and the Thames and its tributaries were swollen to an extraordinary degree. At Shrewton the chalk springs were higher than had been recorded for 140 years. The approach of an anticyclone from the south-west brought a temporary improvement in the weather over the south and south-east of England between the 10th and 12th, but over the country generally unsettled conditions continued. Temperature increased and on the 13th rose to 55°, or slightly above in nearly all parts of England and Ireland, and to 50° at many stations in Scotland. A depression which passed across the northern part of the country in an easterly direction on the 14th and 15th, occasioned strong south-westerly winds generally, with heavy rain over Scotland and the north of England. Numerous stations had more than 1·00 in. of rain on either day, and on the 15th there was 2·20 in. at Seathwaite, and 2·13 in. at Arncliffe. A large anticyclone extended over the British Isles from the Atlantic on the 17th, and for some days a more settled type of weather was experienced. A depression over the Netherlands on the morning of the 22nd passed down the English Channel, and heavy snow fell over the whole of the south-east of England. At many stations in Surrey it was about a foot deep, and caused much damage. In London traffic was much delayed and the telegraph and telephone services were interrupted. Severe frosts occurred generally on the 22nd and 23rd, and on the latter day the shade minimum temperature at Tunbridge Wells and Clacton was 18°. Slight and indefinite changes of pressure occurred during the last days of the month, and the weather was cold and the rainfall slight in all districts.

In London the weather was mild and wet throughout, the total rainfall at Camden Square, 4·12 in., being the greatest in January in the 58 years' record, with the exception of January, 1877, when 4·74 in. was measured. The mean temperature, 39°·7, was 1°·2 above the average. The duration of sunshine was 29·9 hours, and of rain 86·5 hours. Evaporation, ·11 in.

The rainfall of the month was above the average over practically the whole of the British Isles, the excess being greatest in the south of England. More than 3·00 in. fell south of a line joining Yarmouth and Bristol Channel, except on the lowland of East Anglia and in the Thames Estuary. There were many scattered areas in the south with more than 5·00 in. of rain. On the Pennines 8·00 in. or more fell generally, but the fall diminished to less than 4·00 in. on the Lancashire coast and to less than 3·00 in. over the greater part of the north-midland counties. Part of the south-east of Scotland had less than 2·00 in., but to the west of the Grampians the fall was generally above 5·00 in., and exceeded 10·00 in. in the wet regions of Argyll and Inverness-shire. In Ireland some stations in the east and south-east had about 2·00 in., while there was 4·00 in. in the north and over the greater part of the central area and as much as 12·00 in. at some wet stations in Kerry and Galway.

Over the Kingdom as a whole the general rainfall expressed as a percentage of the average, was as follows: England and Wales, 148; Scotland, 108; Ireland, 115; British Isles, 127.

Climatological Table for the British Empire, August, 1914.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	85·5	24	47·1	8	75·5	54·7	56·9	80	128·9	42·8	1·24	9	5·4
Malta	86·0	8	68·4	3	81·1	64·5	...	76	138·0	...	·07	1	0·8
Lagos	87·0	3, 21	68·0	12	81·9	71·7	69·8	78	153·3	61·0	·84	12	7·3
Cape Town	73·7	20	36·9	12	61·8	45·9	47·8	80	...	...	4·38	15	5·2
Natal, Durban ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	72·2	31	25·8	25	61·8	40·5	31·5	57	...	24·3	·85	1	1·4
Mauritius	76·5	30	57·8	30	74·7	62·6	58·7	72	...	50·7	1·71	21	5·2
Bloemfontein	76·8	31	25·8	1	64·1	38·0	30·8	53	...	...	·52	2	2·3
Calcutta...	92·7	22	73·6	5	88·6	79·4	77·9	85	...	72·0	9·40	13	8·4
Bombay...	86·9	30	75·8	14	84·5	77·6	76·4	86	130·5	65·2	12·44	30	7·8
Madras	100·0	1	73·8	11	93·2	77·1	73·0	75	157·6	72·5	9·41	16	6·5
Colombo, Ceylon ...	88·0	27*	73·2	5	85·9	76·1	73·9	79	156·2	69·9	1·49	9	7·1
Hongkong	94·0	31	75·0	15	87·9	78·2	74·9	79	...	...	4·21	16	6·3
Sydney	74·0	18	44·9	11	64·7	50·0	46·4	68	121·3	34·0	2·13	9	4·6
Melbourne	72·4	27†	33·0	10*	60·6	44·3	41·5	63	117·5	24·6	·66	10	6·0
Adelaide	78·8	27	40·3	25	68·0	48·5	43·9	58	131·6	28·1	·35	7	3·6
Perth	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie	80·6	25	40·8	4	69·2	46·2	41·2	49	141·2	35·0	2·27	7	2·8
Hobart, Tasmania ..	71·6	28	33·5	30	57·3	43·1	38·4	60	116·0	24·0	1·16	14	6·5
Wellington	62·8	19	31·4	15	55·5	41·8	41·5	77	117·0	22·4	1·16	8	5·5
Auckland	60·0	22	40·5	5	56·4	44·5	44·9	81	120·0	38·0	1·16	20	4·7
Jamaica, Kingston ..	94·0	9	72·2	26	90·7	74·1	71·8	78	...	...	·80	10	3·8
Grenada	87·0	sev.	72·0	19	84·7	75·1	...	77	136·0	...	6·86	22	5·6
Toronto	92·0	7	48·1	26	77·8	58·4	59·5	78	145·0	46·0	5·20	16	4·4
Fredericton	85·0	7, 10	39·0	28	74·3	51·4	...	77	...	...	3·94	12	5·1
St. John, N.B. ...	75·2	12	46·5	26	66·6	54·1	55·0	83	...	...	2·93	16	6·1
Alberta, Edmonton ...	86·2	1	41·5	23	72·9	49·5	...	66	137·2	36·0	2·59	13	3·9
Victoria, B.C.	81·8	19	45·9	29	67·3	51·6	...	75	...	...	·18	4	2·5

* and 30. † and 28.

Mauritius.—Mean temp. 0°·2 above, dew point 0°·5 below, and R ·77 in. below, averages. Mean hourly velocity of wind 14·4 miles.

COLOMBO.—Mean temp. 81°·0 or 0°·2 below, dew point 0°·5 above, and R 1·23 in. below, averages. Mean hourly velocity of wind 5·9 miles.

HONGKONG.—Mean temp. 82°·3. Mean hourly velocity of wind 8·6 miles. Bright sunshine 244·9 hours.

Adelaide.—A most abnormal month, unparalleled in the history of the Observatory. Warmest and driest on record.

	1914.	Average.	Previous highest.	Date.
Mean Max.	68°·0	61°·9	66°·3	1860
,, Min.	48°·5	45°·8	48°·3	1877
,, Temp.	58°·3	53°·9	56°·5	1911
Total Rain	·35 in.	2·50 in.	·76 in.	1911
Mean Relative Humidity ...	58 p.c.	71 p.c.	64 p.c.	1913
Sunshine	207·5 hrs.	159·6 hrs.	195·3 hrs.	1891 & 1899

Hobart.—Mean temp. 2°·4 above, and R ·66 in. below, averages.

Wellington.—Mean temp. 0°·3 above, and R 3·50 in. below, averages. Bright sunshine 180·7 hours. Frosts on 14 days.

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TREE GROWTH AS A MEASUREMENT OF RAINFALL.

Visitors to botanical museums are familiar with the appearance of a cross-section of a large tree, showing the consecutive rings of annual growth, by which its age may be measured. In some cases the museum authorities have numbered the rings and placed labels against those corresponding to historical events. In the museum at Wellington, for instance, the history of geographical exploration is thus set forth on a section of a great kauri pine, which was a tree of substantial growth before Columbus set out on his first voyage, was many feet in diameter when the tainui—the canoe which carried the first Maoris to New Zealand—landed upon that island, and had added only a few inches to its circumference since Captain Cook touched those shores.

Two years ago Mr. A. E. Douglass, of the University of Arizona, paid us a visit in London, and described the method which he had been pursuing in connection with sections of the great pine trees of the Western States, in order to determine not the age only of the tree, but the character of the various seasons during which the concentric layers had been added to its girth. We were able on that occasion to help Mr. Douglass to obtain sections of European trees, the place and date of the felling of which could be fixed, so that he could apply the long records of European rainfall to the appropriate years' growth and obtain the direct test of the accuracy of his method of meteorological retrospect.

Mr. Douglass has sent us an interesting monograph entitled "A Method of Estimating Rainfall by the Growth of Trees," published by the American Geographical Society, in their Bulletin for May, 1914, in which he describes in detail the methods and the preliminary results of his researches. The particular region dealt with was Prescott, a district in the northern plateau of Arizona, where the seasonal distribution of rainfall makes a very marked contrast between the growing and the resting period of the year, and where the giant pine trees form a library of archives extending back for many centuries. The method required the comparison of a number of tree sections, for it would obviously be impossible

to accept the evidence of one series of rings, unless it were in harmony with several others compiled by the trees growing in the same neighbourhood. The work was not altogether so simple as might appear, for cases were found in which more than one ring was added in a single year, and others in which the growth rings of two years were so close together as to be merged in one. The reasoning by which the difficulties of interpretation were overcome is set out at length by Mr. Douglass in his paper, but we are unable here to do more than to refer to the conclusions which he drew from the research which he describes.

In order to adapt the long record of tree growth deduced from the Arizona pines to the study of meteorological cycles, Mr. Douglass proceeded as follows. He constructed a curve, and corrected it empirically for age by "drawing a long, sloping, nearly straight line through it from end to end, averaging its growth, and then calculating the percentage of departure of each year from this line. In order to bring out the longer variations the curve was smoothed by 20-year overlapping means. The result gives four conspicuous crests about the years 1400, more or less, 1560, 1710, and 1865, suggesting a very long period. A period of 33·8 years fits very well since 1730, with a total amplitude of some 25 per cent., and very poorly before that, yet without entire discordance. The last crest came in 1900. This we readily identify as the well-known Brückner period. The most persistent of the longer periods seems to be approximately 21 years in length, with an average amplitude of 20 per cent. (10 per cent. from the mean), and its last crest in 1892. This pulsation is well marked from 1400 to 1520; then in the next hundred years it has three or four glaring discrepancies; finally from 1610 to the present time it is again strongly marked and very regular. Dr. W. J. S. Lockyer, in his "Discussion of Australian Meteorology," finds a pronounced 19-year cycle in barometric pressures in Australia and South America. The 21-year period was worked out independently in 1907 and 1908, from an early and crude tree record of 200 years. It seems quite possible that these two periods are the same. If so, and if my interpretation of the tree curves is correct, the real value is likely to be closer to 21 years, since the time interval here investigated is about ten times as long as his. . . . . the application becomes more evident when the minor variations are smoothed. . . . . In nearly all parts of the long, 500-year cycle, there are plain suggestions of an 11-year variation. By tracing these throughout the record, the most satisfactory period is found to have a length of very nearly 11·4 years, which is practically the sunspot cycle. The average double amplitude of the tree period is 16 per cent. The average form of this cycle during different portions of the last five centuries has been ascertained, from which it appears that it is not uniform throughout. In general the curve shows two maxima and two

minima : from 1400 to 1670, the second is the deeper and its recurrence most regular ; from then to 1790 the curve flattens out and has less marked cyclic character, or the period of the cycle is varying ; from that time to the present, there are again two minima, but the first is more conspicuous. By comparing the crests of this cycle with the respective crests in the tree curve, one can see to what degree the tree varies on that particular cycle. Correlation between tree growth and sunspot variation is not confined to the American region here investigated. A series of measures on thirteen tree sections (Pinus sylvestris) from the forest of Eberswalde, near Berlin, Germany, the first of a number of series to be made on North European pine trees, discloses a striking time relation of similar character. A final comparison of the 11-year cycle with the mean sunspot curve and with two meteorological elements, temperature and rainfall, on the adjacent California coast, gives a significant series of curves."

Mr. Douglass concludes as follows : "Further research will probably show other, and perhaps still more important, relationship between the growth of vegetation, meteorological elements and changes in the sun. Meanwhile, the methods of computing rainfall from tree growth must be still further perfected. Already, however, the original purpose of the work here outlined has been accomplished. A connection has been found between tree growth and rainfall, a curve of tree growth has been made for at least one locality, apparent climatic cycles have been observed and indications of association between meteorological and astronomical phenomena have been found. But the most important part of all, I hope, has been the origin and development of a method of estimating rainfall, capable of extension to other regions, and of adaptation to other branches of science."

REVIEWS.

Dew-Ponds, History, Observation, and Experiment. By EDWARD A. MARTIN, F.G.S. London. T. Werner Laurie, Ltd. [Not dated, 1915 ?] Size $7\frac{1}{2} \times 5$. Pps. 208.

THE researches on dew-ponds carried out by Mr. Martin, have already been referred to in this Magazine, **44** (1909) pp. 57 and 77. The results are now summarised in the small volume before us, where in five chapters Mr. Martin deals with I. Their age and history ; II. Theories of dew-pond action ; III. Varying modes of dew-pond construction ; IV. Experiment and observation ; V. Summary and Conclusions. There is also an appendix, mentioning the particular ponds which had come under the Author's observation.

Mr. Martin's results entirely confirm the opinion we have frequently expressed regarding the predominant part played in the filling and maintenance of these ponds by rainfall, and the negligible quantity of the additions by direct condensation of dew.

Mr. Martin finds as of course all meteorologists understood, that ponds on the summit of the South Downs are, to some extent, replenished by precipitation from mist, especially when trees stand near the pond, and he points out that this very obvious action had been so fully appreciated in some localities as to give to those artificial saucers of water the name of mist pond.

The book is pleasantly written and repays perusal, not only on account of the elaborate system of observations which show how strenuously the author tested the old superstition of the action of dew, but also for the practical hints he gives as to the construction of ponds on high Downs, where a supply of water must be very valuable to farmers. There are frequent references, although not always sufficiently full or definite, to previous work on dew and dew-ponds, but we greatly miss a systematic bibliography which the extent of Mr. Martin's researches must have made a comparatively easy matter. We trust that, should the book reach a second edition, a full bibliography will be added. The illustrations include a number of excellent photographs of dew-ponds and diagrams showing their formation.

The Thermometer and its Family Tree ; The Mountains of Cloudland and Rainfall Humidity ; its effect on our health and comfort ; The Barometer as the Foot Rule of the Air ; Practical Hints for Amateur Weather Forecasters. Five Pamphlets by P. R. JAMESON, F.R.Met.Soc., Rochester, N.Y. Taylor Instrument Companies. Size 8 × 5. Pp. (each 24). Price 10 cents (each).

THIS is a series of dainty booklets with extremely attractive and well designed pictorial covers, and well illustrated in the text. They are written in a fresh and interesting style, likely to turn the attention of a casual reader to the study of the atmosphere, and with a few obvious modifications they should prove as useful in the United Kingdom as in the United States. In "The Barometer as a Foot Rule of the Air," it is rather surprising to find that most of the space is devoted to Aneroids, and that there is no illustration of a mercurial barometer, while in "The Mountains of Cloudland and Rainfall," the suggestion is made that a tipping bucket rain gauge recording on a dial in hundredths of an inch, is more accurate than a direct reading instrument. No doubt, both the points to which we take exception would stand if the mechanism employed always remained as perfect as when first put together, but experience shows that the greatest accuracy over a long period is obtained by direct eye measurements.

THE WET WINTER OF 1914—15.

WHILST it is as yet too early to prepare any complete account of the rainfall of the past winter, an examination of the tables of rainfall of each month, which appear in this Magazine, provides a preliminary idea of the distribution of rainfall in relation to the average, and of the districts in which the fall has been most excessive.

Taking the British Isles as a whole four months, November and December, 1914, and January and February, 1915, were all wet, and of these December and February were, relatively to the average, the wettest. The fall in November was below the average in the south of Ireland and south-west of Wales, but above it in all other parts of the British Isles, and rose to 50 per cent. above in parts of the north. December was wet everywhere, especially in the south, more than twice the average falling over an area which embraced the east of Ireland and the whole of England south of the Pennines. More than two and a half times the average fell in the south-east of England, and more than three times the average in Sussex. The excess in December was smallest along the west coasts of Ireland and Scotland, where it was below 50 per cent. The rainfall of January exceeded the average in England and Wales, reaching twice that amount at a few stations in England, again chiefly in the south-east. The average was also exceeded in the west of Scotland and Ireland, where the excess in December was least marked, but less than the average fell in the south and east of Ireland and the interior of Scotland, the deficiency in one or two instances amounting to nearly 40 per cent. The general fall was, however, above the average in both countries. In February more than twice the average rainfall was again recorded in the south of England and Wales, in Yorkshire, and in the south and east of Scotland.

The following table shows the general rainfall of each of the four months in terms of percentages of the average for each of the great divisions of the country, as calculated from the monthly tables.

General Rainfall, November, 1914—February, 1915.

	England & Wales. per cent.	Scotland. per cent.	Ireland. per cent.	British Isles. per cent.
November, 1914.....	133	134	124	131
December, 1914.....	201	152	187	183
January, 1915.....	148	109	115	127
February, 1915.....	196	166	176	181
Nov., 1914—Feb., 1915	168	139	150	155

It will be seen that the excessive rainfall of the winter generally ulminated in England and Wales, where December and February

each had practically double the average fall. Taking the whole period together the British Isles experienced a rainfall more than 50 per cent. in excess of the average, Scotland and Ireland having rather less than this proportion, and England and Wales rather more. It is not possible in the time at our disposal to compare this remarkable record with those of past wet winters, but there seems little doubt that no winter in the last half century had a higher rainfall over the country as a whole. The rainfall of the four months was more than double the average over a part of the south-east of England, including London, Surrey, and Sussex, and was half as much again as the average over the whole of England, except the portion north of the Tees, over the centre of Scotland, and over the east and centre of Ireland. The excess was least pronounced in the north of Scotland.

The fact that the area with highest rainfall lay in the south of England gives a special interest to the maps of the distribution of rainfall over the Thames Valley district, which appear each month in this Magazine. There is no large area in the British Isles for which the general rainfall has been determined for so long a period as for the Thames Valley above Teddington, and we are able to refer to statistics for each month from 1883. Comparing the general fall for the past four months with the average of this period we get the following table :—

General Rainfall of the Thames Valley.

	General Rainfall.	Average.	Difference from Average.	Percentage of Average.
November, 1914.....	3·56	2·66	+ ·90	134
December, 1914.....	7·21	2·75	+4·46	262
January. 1915.....	3·85	2·14	+1·71	180
February, 1915.....	4·57	1·81	+2·76	250
Nov., 1914—Feb., 1915	19·19	9·36	+9·83	205

During the 32 years, one month only, October, 1891, with 7·41 in., has had a larger general rainfall than December, 1914. Two months only have had a larger rainfall in relation to the average than either December, 1914, or February, 1915, viz., September, 1896, with 315 per cent., and February, 1900, with 277 per cent., of the average. There has been no period of four months, previous to the past winter, in which the aggregate general rainfall over the Thames Valley was so much as double the average, the nearest approach to this state of things having been from December 1911, to March, 1912, inclusive, when 17·18 in., or 194 per cent. of the average fell. During the famous Thames Valley floods of the autumn of 1894, the greatest excess noted in a period of four months, was from August-November, 1894, when the general rainfall amounted to 136 per cent. of the average.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of the Society was held on February 17th, at the Surveyors' Institution, Westminster, Captain H. G. Lyons, F.R.S., President, in the Chair.

A paper entitled "The Influence of Weather Conditions upon the Amount of Nitric Acid and of Nitrous Acid in the Rainfall at and near Melbourne, Australia," by Mr. G. Anderson, was read, in the absence of the author, by Col. H. Mellish. Whilst necessarily dealing at some length with the chemical processes employed, the author studied his observations in the light of the weather conditions prevailing at the time when the rain samples were collected, previous investigations of the amount of oxidised nitrogen in rain water having been conducted almost entirely from the standpoint of the agricultural chemist, and irrespective of the associated weather. Experiments were carried out simultaneously at Melbourne and at Canterbury, six miles distant. Samples of each day's rainfall, from November, 1912, to February, 1914, inclusive, were analysed, to find the amounts of nitrates and nitrites present, but as a comparison of the records of the two stations established beyond doubt, the existence of impurities in the rainfall of Melbourne, the Canterbury record alone was used for the investigation. In regard to the relative proportions, nitrates appeared always to be in excess of nitrites, and the excess reached a maximum in summer and a minimum in winter, showing a close relation to the temperature curve. In examining the daily results in conjunction with the weather charts, the conditions at 9 a.m. on the previous day were considered as representing the prevailing weather type for the twenty-four hours. Nine weather types were distinguished, according to the grouping of the isobars. A graphic study of the results justified the conclusion that the total amount of nitrates dissolved in the rain was a function of the weather type, the smallest amounts being present during antarctic depressions, the largest during tropical depressions and intermediate amounts in the case of weather under both influences. In all cases the great bulk of the combined nitrogen appeared to be contained in the first ·05 in. of rain falling. In conclusion Mr. Anderson stated that experiments were also being made to discover the influence (if any) of geographical position upon the oxidised nitrogen constants for the different types of weather. If these constants did not vary greatly from point to point, it would be possible to estimate with certainty the annual amounts of oxidised nitrogen contributed by the rain to the soil from a knowledge of the number and types of the rainstorms at any place during the year. At this stage it was considered safe to predict that in tropical Australia the annual amounts contributed were comparatively large.

A discussion followed, in the course of which Dr. E. J. Russel,

compared the results obtained with those studied at Rothamsted and elsewhere. These confirmed in most respects those of Mr. Anderson, but the amounts obtained were smaller and samples analysed from the Outer Hebrides and from Iceland showed still less than at Rothamsted. Nitrogen, in the form of ammonia, constantly emanated from the soil, and he suggested that this might be partly the source of atmospheric oxides of nitrogen. This was supported by the fact that the greatest quantities were noticed in types of weather in which the wind came from the land, rather than from the sea, and samples obtained at the Butt of Lewis were almost entirely free from ammonia.

Dr. A. Scott, F.R.S., criticising Mr. Anderson's theory of the equal production of nitric and nitrous acids, laid stress on the instability of the nitrous, which rapidly oxidised to form nitric acid.

The following gentlemen also spoke : Prof. W. Dunstan, F.R.S., Dr. W. N. Shaw, F.R.S., Capt. D. Wilson-Barker, Mr. M. J. R. Dunstan, and Dr. C. Chree, F.R.S.

A paper on "Pilot Balloon Observations," by Mr. Geddes, was read in his absence, by Mr. J. S. Dines. Mr. Geddes classified the ascents according to the manner in which the balloon was lost to view, differentiating the various types of clouds in which many of the balloons disappeared, and discussed the apparent influence on the vertical velocity which these types exerted. Beneath clouds of the cumulus type there was a strong tendency to an increase in the vertical velocity when nearing the base of the clouds. Mr. J. S. Dines exhibited some diagrams of his own observations, which showed that this effect was not always present.

In regard to the author's discussion of the altitude at which the gradient velocity was attained, both Dr. W. N. Shaw and Dr. C. Chree criticised the pre-supposition of the force of this wind, which appeared to have influenced unduly the conclusions drawn from the observations.

The following new Fellows were elected to the Society : Messrs. Vivian Gabriel, George Matthews, and A. D. Richie.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE SEASONS: A REJOINDER.

Touching Mr. Aldridge's disagreement with my arrangement of the seasons I hold that by putting a somewhat narrow consideration like air-temperature alone, before the various effects directly associated with the height and power of the sun, and the intensity

and duration of day-light, he is substituting the secondary for the primary meaning of the seasonal groups.

I should like to accentuate my point by a practical illustration or two. I once asked a fine old lady who had observed the round of many a year at her west-country farm, what she considered to be the depth of winter, and she promptly replied, the season when the days just "open and close"—that is, around the December solstice. If Arctic rigours of frost and snow came in February the season was, nevertheless, early spring to that lady's imagination.

Again, who can observe the illumined northern horizon, with the midnight sun not many degrees below it, on any clear English June night, without realizing that the climax of the year has been reached, and remembering those lines of Wordsworth on the longest day?

> "Summer ebbs :—each day that follows
> Is a reflux from on high,
> Tending to the darksome hollows
> Where the frosts of winter lie."

The division of the year into solstitial and equinoctial groups is really our only solid bed-rock; moreover, it is mathematically precise, and of world-wide signification, whereas purely meteorological and phenological arrangements of the seasons are indefinite, overlapping, and often of merely local application. If, as Mr. Aldridge would have it, autumn *primarily* means tinted and falling leaves, then according to horse-chestnut and lime, the season falls in southern England early in September, but according to oak and elm, not till late October, whilst the ivy has the eccentric habit of having its floral *spring* in October.

With regard to the rival claimants, May and August, for the third place among the summer months, it should be noted that May not only has more sunshine in accordance with its solstitial position, but the month is for some meteorological reason, the sunniest of the English year, notwithstanding that June, and to a small extent, July, are more solstitial with longer days. As for the cold snaps in May, for which Mr. Aldridge would disqualify the month as a summer candidate, all that can be said about them is that they are more pronounced in severity than, but not very different in type from, those chilly periods from which even July is not free.

Finally, Mr. Aldridge refers to the rigours of February, 1895, as indicating winter, and not spring. Now both February, 1895, and December, 1890, had the same mean temperature in London, but to the intense cold of December, 1890, was added the gloom of the winter solstice, with the result that that month was climatically the most formidable that has been experienced in the south of England during the quarter of a century now just ended.

L. C. W. BONACINA.

February 21st, 1915.

FORECASTING WEATHER BY MEANS OF CORRELATION.

MR. HAMPTON BROWN comments on the possibility of forecasting weather by means of correlation, but unfortunately, when the formula is considered by which the forecast is made, it is seen at once that the chance of a successful forecast is very small, unless the correlation is very high.

This will appear from the following special case. Both the height of the barometer and the mean temperature, taken as a departure from the month's mean, from one day to the next, are highly correlated, the coefficients being about ·80. If the correlation were efficient for the purpose of forecasting, any local Observer should be able to forecast to-morrow's weather from to-day's, but he cannot do so, neither is the reason far to seek.

If to-day's temperature be 10° above the mean and the correlation between to-day's and to-morrow's temperature be ·80, then the most likely value for to-morrow is 8° above the mean, the 8° being formed by multiplying 10° by ·80. So far so good, but the most probable value is not by any means that which will certainly occur. In the long run the mean of the days which follow days that are 10° above the mean will be 8° above the mean, but the rule does not hold for the individual day, and the question is by how much is the forecast likely to be wrong. Naturally this depends upon the extent to which any day's temperature is likely to vary from its mean, and some measure of this variability must be adopted. It is usual to take a quantity called the standard deviation, which, in this special case, is about 6° F. This means that two days out of three, or nearly so, are within 6° F. of their own special mean, and one out of three departs from it by more than 6° F. Now, employing the correlation coefficient, ·80, to-morrow's temperature can be estimated with a correctness of $6° \times \sqrt{1-·80^2}$, *i.e.*, 3°·6 F., instead of 6° F. That is, a pure guess at to-morrow's temperature will, in one case out three, be more than 6° F. out, but using the correlation with to-day's temperature (our ·80) one forecast out of three will be more than 3°·6 out. The badness of the guess, so to speak, is reduced in the ratio of 6° to 3°·6, and in general where r is the correlation coefficient the ratio is $1 : \sqrt{1-r^2}$.

In the following table values of $\sqrt{1-r^2}$ for a few values of r are given :

r.	·10	·50	·70	·80	·90	·95	·98
$\sqrt{1-r^2}$	·99	·87	·71	·60	·44	·32	·20

From this it appears that correlation coefficients are practically useless for the purpose of forecasting, unless they are very high indeed. A value of ·50 only makes the forecast 13 per cent. better than a pure and simple guess ; ·95 is required to improve a guess in the ratio of 1 to 3 ; and ·98 for the ratio of 1 to 5.

The statistical treatment of questions of this kind is really very simple, and if one is willing to accept without proof a few formulæ very little knowledge of mathematics is required. It would well repay any meteorologist to learn how to use the more elementary statistical methods, for by them certain conclusions can be reached which are absolutely trustworthy within known and well defined limits.

W. H. DINES.

RAINFALL OF THE PAST AUTUMN AND WINTER.

THE amount of rain measured at Clifton during the four months, November and December, 1914, and January and February, 1915, is 19·58 in., which is about 8 in. in excess of the average of 37 years' observations by Dr. Burder, 1853-89.

I have compared this heavy fall with previous meteorological records of this district back to 1853, but cannot find a parallel. During the similar four months of 1876-7, I measured 18·42 in. of rain, and in 1911-12, 18·54 in. were recorded at Clifton. These are the heaviest amounts in 62 years, and are each about an inch less that the exceessive fall of the four months just ended.

W. F. DENNING.

Bristol, March 2nd, 1915.

METEOROLOGICAL NEWS AND NOTES.

THE WRECK OF TWO GERMAN ZEPPELIN AIRSHIPS in Denmark in February, drew the attention of the Press to the fact that the daily barometric maps of the air over Western Europe are as vital to the navigation of these vessels as the Admiralty Charts of the North Sea are to the navigation of war ships. *The Times* reported that the Danish Meteorological Institute at Copenhagen had stated that the loss of these air ships was directly due to the action of the British Meteorological Office in suppressing the daily telegrams from British stations, on which alone the probability of the snow squalls which proved fatal to the Zeppelins could be foretold. This opinion, in which we fully concur, should reconcile all patriotic British subjects to the retarded appearance of the Daily Weather Reports in the present unprecedented circumstances.

BRITISH RAINFALL, 1914, now in course of compilation, will contain an innovation in the shape of the publication of the total annual rainfall at each station in millimetres as well as inches. In order to admit an additional column in the general table the width of the page will be slightly increased, but the height will remain unchanged, so that the volume will range with its predecessors on the shelf.

RAINFALL TABLE FOR FEBRUARY, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea.	RAINFALL OF MONTH.	
					Aver. 1875—1909.	1915.
		° ′	° ′	ft.	in.	in.
Camden Square	*London*	51 32	0 8	111	1·66	3·42
Tenterden	*Kent*	51 4	*0 41	190	1·90	4·41
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·17	4·50
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·28	5·45
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	1·62	3·08
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	1·70	2·28
Shoeburyness	*Essex*	51 31	*0 48	13	1·19	1·61
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	1·59	2·72
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	1·41	2·94
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	2·95	8·78
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·50	5·44
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·12	4·57
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·17	5·04
Boston	*Lincolnshire*	52 58	0 1	11	1·53	2·15
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	1·64	2·67
Mickleover Manor	*Derbyshire*	52 54	1 32	280	1·71	2·38
Macclesfield	*Cheshire*	53 15	2 7	501	2·30	3·64
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	2·07	3·55
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	4·88	10·07
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	1·71	3·46
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	1·78	3·42
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	1·63	2·60
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	[1]0·96	20·40
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	3·07	5·48
Haverfordwest	*Pembroke*	51 48	4 58	90	3·42	7·89
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	3·09	6·31
Llandudno	*Carnarvon*	53 20	3 50	72	2·11	3·56
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	3·42	11·10
Marchmont House	*Berwick*	55 44	2 24	498	2·15	2·94
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	3·87	8·48
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	2·70	4·49
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	5·71	9·53
Mull (Quinish)	,,	56 34	6 13	35	4·45	5·67
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	1·91	4·48
Braemar	*Aberdeen*	57 0	3 24	1114	2·55	7·89
Aberdeen (Cranford)	,,	57 8	2 7	120	2·36	4·13
Gordon Castle	*Moray*	57 37	3 5	107	1·95	2·93
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	4·20	3·31
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	7·53	8·37
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·58	3·41
Wick	*Caithness*	58 26	3 6	77	2·23	2·51
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	4·99	9·99
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	3·18	5·38
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	2·89	4·98
Ennistymon House	*Clare*	52 57	9 18	37	3·44	6·06
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·75	5·21
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·55	4·66
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	1·93	3·28
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	2·67	5·11
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	4·20	6·62
Cong (The Glebe)	,,	53 33	9 16	112	3·72	5·99
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·20	5·93
Seaforde	*Down*	54 19	5 50	180	2·81	5·94
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	2·56	3·07
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	2·68	4·26

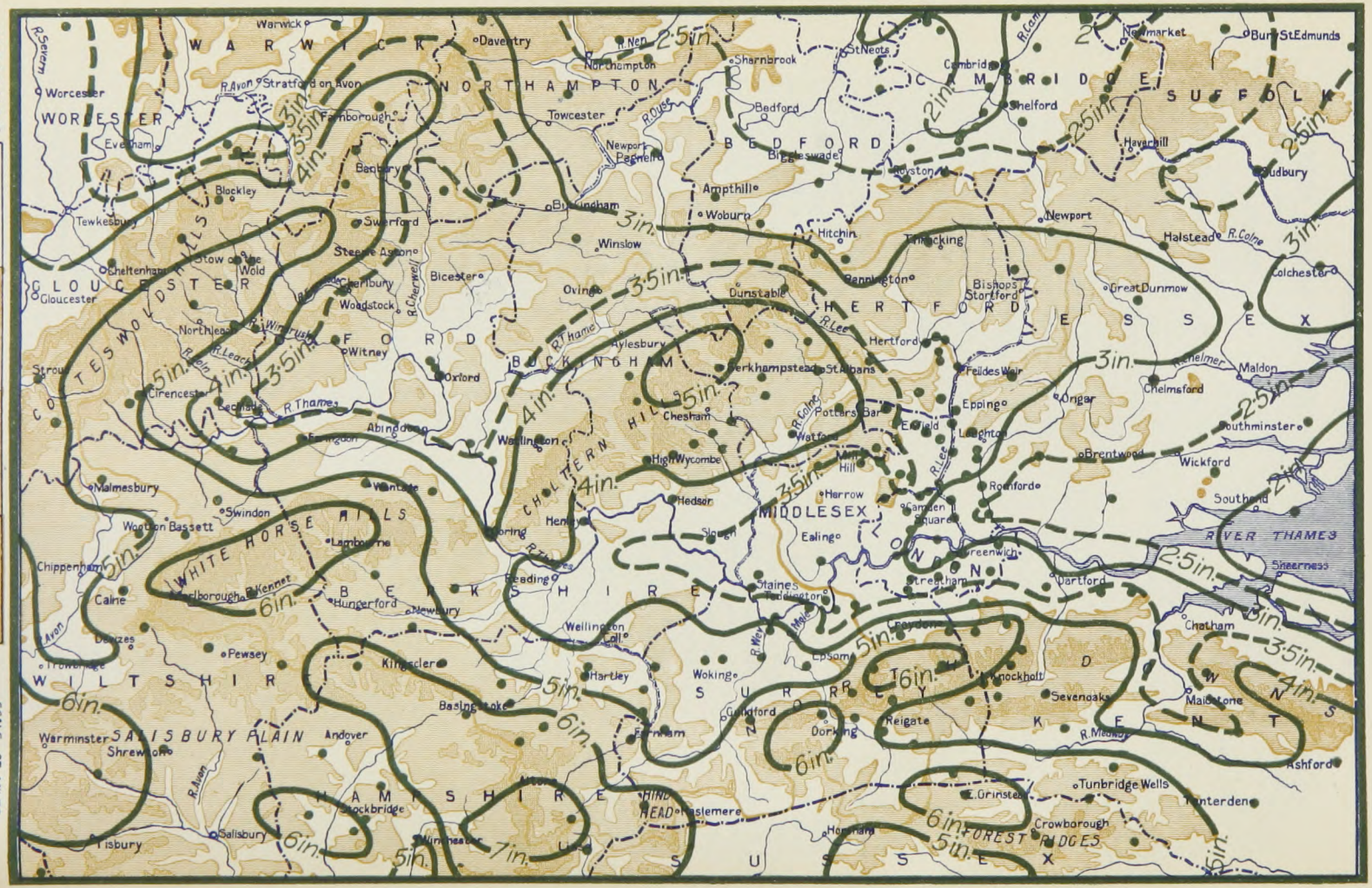
RAINFALL TABLE FOR FEBRUARY, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875—1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
+1·76	206	·45	8	18	3·49	7·54	+4·05	216	25·11	Camden Square
+2·51	232	·97	13	19	4·04	7·63	+3·59	189	27·64	Tenterden
+2·33	208	·75	8	18	4·76	9·55	+4·79	201	30·48	Patching
+3·17	239	·85	16	20	5·03	9·63	+4·60	192	31·87	Cadland
+1·46	190	·40	13	20	3·40	5·92	+2·52	174	24·58	Oxford
+ ·58	134	·39	7	16	3·60	4·79	+1·19	133	25·20	Swanspool
+ ·42	135	·28	13	20	2·52	3·57	+1·05	142	19·28	Shoeburyness
+1·13	171	·40	13	19	3·29	5·42	+2·13	165	25·40	Westley
+1·53	208	·32	13	23	2·94	6·32	+3·38	215	23·73	Geldeston
+5·83	298	1·31	13	24	6·54	13·88	+7·34	213	38·27	Polapit Tamar
+2·94	217	·85	16	24	5·44	9·00	+3·56	165	33·54	Rousdon
+2·45	216	·89	16	21	4·45	7·55	+3·10	169	29·81	Stroud
+2·87	233	·69	13	21	4·68	10·12	+5·44	216	32·41	Wolstaston
+ ·62	141	·44	13	19	3·07	4·70	+1·63	153	23·35	Boston
+1·03	163	·41	13	17	3·34	4·82	+1·48	144	24·46	Hodsock Priory
+ ·67	139	·44	14	14	3·66	5·14	+1·48	140	26·65	Mickleover
+1·34	158	·43	7	19	4·96	9·33	+4·37	188	34·73	Macclesfield
+1·48	171	·46	18	22	4·62	7·53	+2·91	163	32·70	Southport
+5·19	206	1·25	16	22	11·14	19·79	+8·65	177	61·49	Arncliffe
+1·75	203	·46	13	15	3·60	6·88	+3·28	191	26·87	Ribston Hall
+1·64	192	·85	13	20	3·48	6·26	+2·78	179	26·42	Hull
+ ·97	160	·50	7	23	3·53	4·72	+1·19	134	27·94	Newcastle
+9·44	186	3·30	26	22	24·40	37·19	+12·79	152	129·48	Seathwaite
+2·41	178	1·34	16	28	6·72	9·58	+2·86	143	42·28	Cardiff
+4·47	231	1·00	10	20	8·11	12·19	+4·08	150	46·81	Haverfordwest
+3·22	205	1·00	18	24	7·00	13·02	+6·02	186	45·46	Gogerddan
+1·45	169	·47	2	21	4·62	7·13	+2·51	155	30·36	Llandudno
+7·68	325	2·15	26	20	7·52	14·63	+7·11	195	43·47	Cargen
+ ·79	137	·29	2	21	4·55	5·22	+ ·67	115	33·76	Marchmont
+4·61	219	1·07	26	22	8·65	15·03	+6·38	173	49·77	Girvan
+1·79	166	·99	26	21	6·23	6·80	+ ·57	109	35·97	Glasgow
+3·82	167	2·05	1	24	13·05	17·25	+4·20	132	68·67	Inveraray
+1·22	127	·88	1	23	10·00	13·83	+3·83	138	56·57	Quinish
+2·57	234	1·05	7	21	3·92	6·42	+2·50	164	28·64	Dundee
+5·34	309	1·59	7	21	5·47	11·37	+5·90	208	34·93	Braemar
+1·77	175	·92	7	20	4·72	7·55	+2·83	160	32·73	Aberdeen
+ ·98	150	·47	14	20	3·94	5·40	+1·46	137	30·34	Gordon Castle
— ·89	79	·51	1	23	9·78	7·62	—2·16	78	44·53	Fort Augustus
+ ·84	111	1·35	1	22	16·95	19·19	+2·24	113	83·93	Bendamph
+ ·83	132	·60	8	15	5·33	...	...	...	31·90	Dunrobin Castl
+ ·28	113	...	...	...	4·71	4·66	— ·05	99	29·88	Wick
+5·00	200	1·05	3	28	10·93	15·40	+4·47	141	54·81	Killarney
+2·20	169	·97	16	18	6·96	7·67	+ ·71	110	39·57	Waterford
+2·09	172	1·02	8	23	6·77	10·25	+3·48	152	39·43	Castle Lough
+2·62	176	·70	26	25	7·74	12·99	+5·25	168	46·52	Ennistymon
+2·46	190	1·16	16	18	5·94	7·61	+1·67	128	34·99	Courtown Ho.
+2·11	183	·61	26	21	5·70	8·31	+2·61	146	35·92	Abbey Leix
+1·35	170	·43	26	20	4·07	5·38	+1·31	132	27·68	Dublin
+2·44	192	·95	26	23	5·77	10·38	+4·61	180	36·15	Mullingar.
+2·42	158	·81	3	26	9·55	13·40	+3·85	140	52·87	Enniscoe
+2·27	161	·55	2	25	8·51	12·31	+3 80	145	48·90	Cong
+2·73	185	·73	9	25	7·07	11·62	+4·55	165	42·71	Markree
+3·13	212	1·84	16	18	6·22	8·54	+2·32	137	38·91	Seaforde
+ ·51	120	·36	28	21	5·75	5·69	— ·06	99	37·56	Dundarave
+1·58	159	·55	16	24	6·14	8·75	+2·61	142	39·38	Omagh

SUPPLEMENTARY RAINFALL, FEBRUARY, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	6·00	XI.	Lligwy	3·35
,,	Ramsgate	2·81	,,	Douglas	5·30
,,	Hailsham	5·37	XII.	Stoneykirk, Ardwell House...	5·60
,,	Totland Bay, Aston House...	4·53	,,	Carsphairn Shiel	13·30
,,	Stockbridge, Ashley..	6·45	,,	Beattock, Kinnelhead	8·84
,,	Grayshott	6·57	,,	Langholm, Drove Road	9·46
III.	Harrow Weald, Hill House...	3·38	XIII.	Meggat Water, Cramilt Lodge	...
,,	Caversham, Rectory Road ...	4·09	,,	North Berwick Reservoir.....	1·91
,,	Pitsford, Sedgebrook.....	2·27	,,	Edinburgh, Royal Observaty.	1.94
,,	Woburn, Milton Bryant.....	3·04	XIV.	Maybole, Knockdon Farm ...	4·59
,,	Chatteris, The Priory..... ...	1·67	XV.	Ballachulish House	9·59
IV.	Elsenham, Gaunts End	3·20	,,	Campbeltown, Witchburn ..	5·92
,,	Colchester, Hill Ho., Lexden	3·26	,,	Holy Loch, Ardnadam.....	10·67
,,	Ipswich, Rookwood, Copdock	3·38	,,	Islay, Eallabus	5·40
,,	Blakeney..... . ..	2·81	,,	Tiree, Cornaigmore	4·69
,,	Swaffham	2·83	XVI.	Dollar Academy	6·00
V.	Bishops Cannings	5·06	,,	Balquhidder, Stronvar.....	11·89
,,	Wimborne, St. John's Hill ...	6·56	,,	Glenlyon, Meggernie Castle..	10·91
,,	Ashburton, Druid House.. ..	11·89	,,	Blair Atholl	6·32
,,	Cullompton	5·91	,,	Coupar Angus	6·62
,,	Lynmouth, Rock House	7·87	,,	Montrose, Sunnyside Asylum.	4·52
,,	Okehampton, Oaklands.. ...	8·78	XVII.	Alford, Lynturk Manse	4·87
,,	Hartland Abbey.....	5·90	,,	Fyvie Castle	5·17
,,	Probus, Lamellyn.....	7·64	,,	Keith Station	4·33
,,	North Cadbury Rectory.	4·87	XVIII.	Rothiemurchus	...
VI.	Clifton, Pembroke Road.....	4·40	,,	Loch Quoich, Loan	15·60
,,	Ross, The Graig	4·15	,,	Drumnadrochit..... ..	2·84
,,	Shifnal, Hatton Grange.....	2·53	,,	Skye, Dunvegan	6·36
,,	Droitwich.....	3·63	,,	Lochmaddy, Bayhead	4·87
,,	Blockley, Upton Wold.....	4·54	,,	Glencarron Lodge	6·16
VII.	Market Overton.....	3·30	XIX.	Invershin	2·70
,,	Market Rasen	2·96	,,	Melvich	3·10
,,	Bawtry, Hesley Hall	2·27	,,	Loch Stack, Achfary	5·99
,,	Derby, Midland Railway.....	2·63	XX.	Dunmanway, The Rectory ..	11·10
,,	Buxton	5·85	,,	Glanmire, Lota Lodge.....	7·25
VIII.	Nantwich, Dorfold Hall	3·28	,,	Mitchelstown Castle.....	5·75
,,	Chatburn, Middlewood	4·63	,,	Darrynane Abbey.....	8·83
,,	Lancaster, Strathspey	5·12	,,	Clonmel, Bruce Villa	6·01
IX.	Langsett Moor, Up. Midhope	5·44	,,	Newmarket-on-Fergus, Fenloe	4·55
,,	Scarborough, Scalby	3·77	XXI.	Laragh, Glendalough	8·99
,,	Ingleby Greenhow	4·98	,,	Ballycumber, Moorock Lodge	3·55
,,	Mickleton	4·10	,,	Balbriggan, Ardgillan	3·09
X.	Bellingham, High Green Manor	4·18	XXII.	Ballynahinch Castle.....	7·04
,,	Ilderton, Lilburn Cottage ...	3·85	,,	Woodlawn	4·21
,,	Keswick, The Bank.....	9·51	,,	Westport, St. Helens	6·58
XI.	Llanfrechfa Grange	6·00	,,	Dugort, Slievemore Hotel ...	7·77
,,	Treherbert, Tyn-y-waun	15·89	,,	Mohill Rectory	4·73
,,	Carmarthen, The Friary	8·41	XXIII.	Enniskillen, Portora.....	4·62
,,	Fishguard Goodwick Station.	7·56	,,	Dartrey [Cootehill]	4·83
,,	Crickhowell, Tal-y-maes.....	8·50	,,	Warrenpoint, Manor House ..	4·71
,,	New Radnor, Ednol	7·80	,,	Banbridge, Milltown	3·60
,,	Birmingham WW., Tyrmynydd	11·13	,,	Belfast, Cave Hill Road	4·32
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	5·46
,,	Llangynhafal, Plâs Draw.....	4·13	,,	Londonderry, Creggan Res...	3·57
,,	Dolgelly, Bryntirion.....	8·31	,,	Dunfanaghy, Horn Head ...	3·90
,,	Bettws-y-Coed, Tyn-y-bryn...	...	,,	Killybegs	5·46

THAMES VALLEY RAINFALL. — FEBRUARY, 1915.



Symons's Meteorological Magazine.

Watershed of River Thames above Teddington, and River Lee above Feildes Weir

Rainfall Stations reporting ... ... ●

Isohyetals. ———

THE WEATHER OF FEBRUARY.

UNSETTLED weather with strong southerly or south-westerly winds or gales prevailed at the beginning of the month, when a large depression spread over the British Isles from the Atlantic. Heavy rain fell over Ireland and along the west coast of Great Britain, there being 2·71 in. at Ardnadam on the 1st, 2·22 in. at Delphi (Co. Mayo), on the 2nd, and rather more than 2·00 in. at Seathwaite on each day. More than 1·50 in. was recorded at many Scottish stations on the 3rd, and equally heavy falls occurred in the northern half of the Kingdom on the 5th, with heavy hail at Waterford. Temperature was generally high and shade maxima exceeding 50° occurred in all parts of the Kingdom on the 3rd, and 55° or 56° at some stations in Ireland and the north-west and north of Great Britain. A depression off the west of Ireland extended eastward and moved in a northerly direction on the 7th, causing a south-easterly gale and heavy rain or snow on the west coast of Scotland. Local thunderstorms occurred in many places in the south of England on the 8th, at Aberdovey on the 9th, at Blacksod and Scilly on the 10th, and at Jersey on the 11th. On the latter day thick fog prevailed in many parts of England and caused two motor accidents at Mansfield. An unusually deep depression passed across the south of England to the Continent on the 13th, and occasioned south-easterly to south-westerly gales with heavy rain over the southern counties. At Holne (Devon) the fall amounted to 2·47 in. Unsettled conditions continued and on the 16th heavy rain fell over a large area in the south-west of England and snow in the south of Ireland. Many stations in South Wales and Devon had over 2·00 in., and at Treherbert there was 3·51 in., and at Holne 3·44 in. The River Dart at Holne Bridge rose 10 or 12 inches in the night. The continuous heavy rains resulted in high floods in many low-lying districts in the south of England at the end of the third week. Heavy snow fell during the afternoon and evening of the 22nd over the south of England, lying to a depth of 6 inches at Mildenhall and Harrow. Low temperature prevailed from the 23rd to the 25th, shade minima of 12° being reported at Fort Augustus, 13° at West Linton, 15° at Marlborough, and 17° at Llangammarch Wells. The weather during the last week, though less wet than in several preceding weeks, continued unsettled. More than 2·00 in. of rain fell at numerous stations in the Western Highlands and the Lake District on the 26th. There was snow over Scotland and in the Peak District on the 27th and 28th and a thunderstorm with vivid lightning occurred in Derbyshire on the evening of the 28th.

In London it was generally dull or wet with occasional fine sunny days. The rainfall at Camden Square, 3·42 in., was only exceeded four times in February in the preceding 57 years. The mean temperature, 40°·4, was 0°·7 above the average. The duration of sunshine was 54·5 hours, and of rain 67·2 hours. Evaporation, ·13 in.

Only two small areas in England had rainfall less than 2·00 in., viz., the estuary of the Thames and an area in Cambridge and Huntingdon. Almost the whole of the country south of the Thames had more than 4·00 in., and a large part of Devon and Cornwall more than 8·00 in., with an area on Dartmoor exceeding 15·00 in. Less than 3·00 in. fell over nearly the whole of the central portion of England east of Derby and extending from York to Oxford. Practically the whole of Wales had more than 6·00 in. of rain and considerable areas in the mountainous districts had twice this amount. In Scotland less than 2·00 in. fell on the shores of the Moray Firth and the Firth of Forth, but only along the east coast did the total rainfall fail to reach 4·00 in. Large areas in the western Highlands had more than 10·00. In Ireland there was less than 3·00 in. along the coast of Londonderry and in a small area in the north-east but 5·00 in., or more, fell generally south of Wicklow and west of Athlone. Over a large area in the south-west and another in the Connemara district more than 10·00 in. was recorded.

Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was as follows; England and Wales, 196; Scotland, 166; Ireland 176; British Isles, 181.

Climatological Table for the British Empire, September, 1914.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	81·6	7	35·5	30	69·6	48·7	50·6	81	122·8	34·0	1·00	9	4·4
Malta	83·8	12	62·0	25	77·1	67·5	...	76	141·0	...	1·34	3	0·9
Lagos	89·0	28*	70·0	3	85·2	73·0	71·1	74	156·2	67·0	·36	3	6·9
Cape Town	76·7	16	41·2	17	63·9	51·6	50·8	77	...	..	3·05	15	5·8
Natal, Durban ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	84·3	28	40·1	21	76·5	52·1	43·2	57	...	40·1	·11	2	0·2
Mauritius	80·2	21	59·4	16‖	77·7	63·9	60·1	71	...	52·5	1·06	14	5·3
Bloemfontein ...	88·3	29	35·4	2	77·3	48·2	...	...	...	...	1·13	3	1·1
Calcutta...	92·2	29†	74·7	8	88·8	77·9	76·9	84	...	71·3	7·24	14	7·7
Bombay... ...	88·5	26	76·4	16	85·6	78·1	76·5	85	135·2	68·3	21·03	23	6·5
Madras	98·0	2	72·1	22	91·8	76·6	75·2	81	162·4	71·1	6·84	11	4·9
Colombo, Ceylon ...	89·5	29	72·8	28	87·4	75·7	74·0	79	161·8	70·0	4·15	18	6·9
Hongkong	92·1	1	73·2	26	85·4	76·2	70·9	73	...	...	19·98	13	5·1
Sydney	78·8	23	45·2	2	66·9	52·7	49·1	70	131·1	39·1	5·21	12	3·9
Melbourne	80·3	6	34·9	14	61·9	44·5	42·0	63	127·1	28·1	1·09	12	4·6
Adelaide	84·6	7	36·5	20	69·4	46·3	42·6	53	146·5	26.4	·60	7	3·1
Perth	86·3	30	41·2	22	71·5	50·8	48·5	62	149·5	34·5	·62	9	3·2
Coolgardie	91·2	20	37·2	22	75·4	48·2	42·4	44	153·2	36·0	·00	0	1·4
Hobart, Tasmania ..	76·9	8	33·0	20	59·9	42·7	38·9	58	123·8	22·3	1·00	11	4·7
Wellington ...	69·0	25	34·0	19	58·8	45·6	43·7	73	128·6	23·0	1·52	7	6·0
Auckland	68·5	26	41·0	10	59·0	47·6	46·7	77	135·0	40·0	1·45	13	5·5
Jamaica, Kingston ..	94·6	9	72·7	1	90·8	74·2	71·6	76	...	...	·82	3	4·5
Grenada	89·0	19‡	72·0	12	86·2	75·5	...	76	136·0	...	6·63	16	3·0
Toronto	86·8	22	36·6	28	71·2	50·8	51·8	79	132·3	32·8	1·54	9	2·7
Fredericton	90·0	22‡	30·0	28	70·1	46·1	...	77	...	...	2·51	8	4·1
St. John, N.B. ...	77·0	16	34·1	29	62·9	50·4	50·0	79	...	...	2·91	12	4·2
Alberta, Edmonton ...	78·0	25	30·2	16	60·7	39·5	...	75	129·8	24·5	3·54	13	6·4
Victoria, B.C.	71·1	24	43·8	1	58·6	48·5	...	87	...	...	1·98	12	7·2

* and 29. † and 30. ‡ and 22. ‖ and 28.

Johannesburg.—Bright sunshine 306·5 hours.

Mauritius.—Mean temp. of air 1°·0 above, dew point 0·3 above, and R ·47 in. below, averages. Mean hourly velocity of wind, 11·7 miles.

Bloemfontein.—A very warm month.

COLOMBO.—Mean temp. of air 81°·6, or 0·3° above, dew point 0·5 above, and R ·56 in. above, averages. Mean hourly velocity of wind 5·4 miles.

HONGKONG.—Mean temp. of air 80°·4. Mean hourly velocity of wind 9·0 miles. Bright sunshine 215·0 hours.

Melbourne.—Mean temp. of air 0°·8 below and R 1·25 in. below, averages.

Adelaide.—Mean temp. 0°·8 above average. A very dry month, and with one exception, lowest September rainfall.

Coolgardie.—Temp. of air 3°·4 above average.

Hobart.—Mean temp. of air 0°·5 above, R 1·14 in. below, averages, and record hours of sunshine.

Wellington.—Mean temp. of air 52°·2 or 0°·9 above and R 2·72 in. below, averages. Bright sunshine 196·5 hours.

Auckland.—Remarkably dry, rainfall under half the average. Mean temp. slightly under average.

ALBERTA, EDMONTON.—Wet, damp, and cloudy, with average temp. TSS on 3 days.

Symons's
Meteorological Magazine.

No. 591. APRIL, 1915. Vol. L.

THE HOME OF THE BLIZZARD.*

A Review.

If a book with this title had been published a few years ago we should have expected a treatise on the variety of weather of some spot in the centre of North America, between Dakota and Alberta, and our readers may recall the article of an American writer in these pages, Vol. **46** (1911), p. 26, who desired to place upon the town formerly called Medicine Hat the unattractive designation "where the blizzards come from." Antarctic exploration has shown that, although the name of blizzard is of American origin, the full intensity of the phenomenon is only reached on the margin of the Antarctic continent and to measure that intensity we have to consider wind velocities unheard of, save, perhaps in a tropical hurricane, but as yet measured only in the far south. When Admiral Beaufort defined hurricane force the 12th and last degree of wind velocity on his scale as "that which no canvas can withstand" he little thought that the art of exploration should advance so far as to erect tents of far lighter canvas than the top sails of his frigate which should withstand for months winds far transcending his hurricane in force.

In calling the narrative of the Australasian Antarctic Expedition the "Home of the Blizzard," Sir Douglas Mawson seized upon the one element of his environment which could never be ignored. We propose, in this notice, to touch only on some points of Antarctic weather as set forth in these two fascinating and splendidly illustrated volumes. We say nothing of the book itself, except that it has been prepared for press by Dr. A. L. McLean, one of the party whose mind received the characteristic impression of Antarctica like a gramophone record; and we say nothing of

* *The Home of the Blizzard*, being the story of the Australasian Antarctic Expedition, 1911–1914, by Sir Douglas Mawson, D.Sc.B.E. Illustrated in colour and black and white, also with maps. London, William Heinemann, 1915. Size, 10×7. Pp., Vol. 1, xxx.+350, Vol. 2, xiv.+338. Price, 36s. net.

the splendid seamanship of Captain Davis, in landing the two parties which constituted the Expedition at points 1500 miles apart, or of the great land journeys with all their heroisms, their disasters and their triumphs, for all these have been fully dealt with by the newspaper press and literary journals.

The Meteorological work of the Expedition extended over two years and resulted in simultaneous sets of observations of great value. They consisted of (1) Two years' observations at Macquarie Island, practically half-way between Australia and Antarctica, by Mr. G. F. Ainsworth; (2) Two years' observations at Commonwealth Bay in Adelie Land, Sir Douglas Mawson's main base, just within the Antarctic Circle, by Mr. C. T. Madigan; (3) One year's observations in Queen Mary Land, 1500 miles west of Commonwealth Bay and nearly in the same latitude, the base of Mr. F. Wild's party, by Mr. M. H. Moyes; (4) Observations on board the *Aurora* on each of her five voyages in Antarctic and sub-Antarctic waters: (5) Less complete observations taken during the many sledge journeys from both Antarctic bases. The full discussion of all the data is, we understand, being carried out under the superintendence of Mr. Hunt, of the Commonwealth Weather Bureau, and the volumes under review do not contain any forecast of the results. They abound, however, in descriptions of weather conditions of a very interesting character. The most striking and novel feature in the whole expedition was the bold attempt to maintain communication by wireless telegraphy. The intermediate wireless station on Macquarie Island proved a complete success and daily weather reports were transmitted to Melbourne and Wellington for a considerable part of the time. The installation of the wireless masts at the main base in Adelie Land was a proceeding of extraordinary difficulty, and after it was accomplished communication was found to be impossible during the summer daylight and very difficult even in the winter night, but messages were frequently exchanged with Macquarie Island, though so far as we can ascertain, the Adelie Land observations could not reach Australia in time to be utilised for the daily weather forecast.

The measurements of wind force appear to have been made with Robinson Anemometers only, and the skill of the mechanicians had frequently to be exercised in making repairs and modifications to enable the instruments to withstand the terrible conditions in which they had to work. No doubt Mr. Hunt will discuss the question of the appropriate factor to reduce the index readings in these special circumstances to true wind velocities. It is to be regretted that no pressure tube Anemometer was available.

The nature of the prevalent weather may best be judged by a few extracts from the description of the first winter in Adelie Land, when day after day the force of the wind ranged between that of

a gale and that of a hurricane under overcast skies and in the continual presence of drifting snow. "On March 19th the first well-marked lull intervened at the height of a gale. On that day the wind which had been blowing with great force during the morning commenced to subside rapidly just after noon. Towards evening the air about the hut was quite still, except for gusts from the north and rather frequent "whirlies." This was the name adopted for whirlwinds of a few yards to a hundred yards or more in diameter, which came to be regarded as peculiar to the country. . . . . The whirlies tracked about in a most irregular manner and woe betide any light object which came in their path. The velocity of the wind in the rotating column being very great, a corresponding lifting power was imparted to it. As an illustration of this force, it may be mentioned that the lid of the air-tractor case had been left lying on the snow near the hut. It weighed more than three hundredweights, yet it was whisked into the air one morning and dropped fifty yards away. An hour afterwards it was picked up again and returned near its original position, this time striking the rocks with such force that part of it was shivered to pieces . . . . . Again the radius of activity of these whirlies was strictly limited; objects directly in their path only being disturbed. For instance, Laseron one day was skinning at one end of a seal and remained in perfect quiet, while McLean, at the other extremity, was on the edge of a furious vortex. Travelling over the sea the whirlies displayed fresh capabilities. Columns of brash-ice, frozen spray and water-vapour were frequently seen lifted to heights of from two hundred to four hundred feet, simulating water spouts."

In the steady blizzard which more frequently prevailed the practical problem of locomotion naturally acquired an absorbing interest for the explorers. "The first difficulty to be encountered was a smooth, slippery surface, offering no grip for the feet. Stepping out of the shelter of the hut, one was apt to be immediately hurled at full length down wind. No amount of exertion was of any avail unless a firm foothold had been secured. The strongest man, stepping on to ice or hard snow in plain leather or fur boots, would start gliding away with gradually increasing velocity; in the space of a few seconds, or earlier, exchanging the vertical for the horizontal position. He would then either stop suddenly against a jutting point of ice, or glide along for twenty or thirty yards till he reached a patch of rocks or some rough sastrugi. Of course we soon learned never to go without crampons on the feet. . . . . Shod with good spikes, in a steady wind, one had only to push hard to keep a sure footing. It would not be true to say "to keep erect," for equilibrium was maintained by leaning against the wind. In course of time, those whose duties habitually took them out of doors became thorough masters of

the art of walking in hurricanes—an accomplishment comparable to skating or ski-ing. Ensconsed in the lee of a substantial break-wind, one could leisurely observe the unnatural appearance of others walking about, apparently in imminent peril of falling on their faces. Experiments were tried in the steady winds; firmly planting the feet on the ground, keeping the body rigid and leaning over on the invisible support. This "lying on the wind" at equilibrium, was a unique experience. As a rule the velocity remained uniform; when it fluctuated in a series of gusts, all our experience was likely to fail, for no sooner had the correct angle for the maximum velocity been assumed than a lull intervened —with the obvious result."

An Anemograph reproduced on page 117, Vol. I., shows the record for twenty-four hours during which an average velocity of 90·1 miles per hour was maintained, while for individual hours, there was an average velocity of 97 miles. Velocities far exceeding 100 miles an hour were frequently experienced (and gusts approaching 200 were recorded on one occasion, in combination with air temperature as low as —28° F.

What such a storm was like may be gathered from the following:

"Picture drift so dense that daylight comes through dully, though, maybe, the sun shines in a cloudless sky; the drift is hurled, screaming through space at a hundred miles an hour, and the temperature is below zero, Fahrenheit. . . . . Shroud the infuriated elements in the darkness of a polar night, and the blizzard is presented in a severer aspect. A plunge into the writhing storm-whirl stamps upon the senses an indelible and awful impression seldom equalled in the whole gamut of natural experience. The world a void, grisly, fierce and appalling. We stumble and struggle through the Stygian gloom; the merciless blast—an incubus of vengeance—stabs, buffets, and freezes; the stinging drift blinds and chokes. In a ruthless grip we realize that we are

poor windlestraws
On the great sullen, roaring pool of Time."

Similar instances of the intensity of the winds on the north coast of Antarctica have been recorded by other expeditions. We may recall in particular the observations of Mr. Priestley at Cape Adare, during the wintering of the Northern Party of Scott's last Expedition, when a small pebble caught up from the beach was blown against the solar radiation thermometer with such velocity that it cut through the vacuum bulb a clean round hole such as might be made by a rifle bullet without starring the glass. The local restriction of these furious winds is very remarkable. It has frequently been noticed that when a very violent blizzard is blowing off shore there may be little or no wind a few miles out at sea, and

observations seem to suggest that these violent and continuous torrents of air are often thin sheets moving at a certain altitude, and probably in a plane inclined to the horizon, so that the calm to which we have referred may concern only the surface air while the blizzard is still raging a few thousand feet above. The tremendous intensity of wind experienced at Adelie Land and at Cape Adare does not seem to have been met with at inland positions, or in McMurdo Sound, where sea ice extended for a long distance from the shore in winter. The intensity of the wind would thus seem to be associated with the abrupt contact of the intensely cold land ice and the comparatively warm water of the ocean kept free from ice by the off shore direction of the wind, thus the surface temperature of hundreds of square miles of sea could not be much lower than 28° F., while the surface of the land ice and the air over it was probably less than —30° F., so that a difference of about 60° in temperature is maintained between two adjacent areas, and this difference must give rise to very powerful circulatory movements. It is worth noting, however, that the average force of the wind in the Antarctic regions varies greatly from year to year, and in 1912-13 the observations of Scott's last Expedition at McMurdo Sound (simultaneous with those of Sir Douglas Mawson's Expedition in Adelie Land), showed wind forces very much greater than those recorded in the same place during the expeditions of the *Discovery* and the *Nimrod.*

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE WET WINTER.

As it is notorious that the first Canadian contingent struck a peculiarly bad patch of weather this winter on Salisbury Plain, and found that usually rather dry region a swamp of wet and mud. A few statistics may be of interest.

The rain for the last five months, which may be said to have begun on the 4th October, is as follows :—

Month.	Rain.	Computed Av.	Record	Year
Oct	3·22	3·50	9.38	1903.
Nov.	5·64	3·00	7·33	1894.
Dec.	6·96	3·00	8·77	1911.
Jan.	4·73	3·00	6·01*	1906.
Feb.	5·78	2·25	5·78	1915.

* Probably somewhat exceeded in 1877 perhaps 6 35.

It will be seen that only one of the five months exceeded all previous records, viz., February; but the cause of the Canadian discomfort is not far to seek, when we find that whether we take the whole five months, the last four, the last three, the last two, or the last one, in each case all records are exceeded for the respective periods.

Early in January the chalk springs rose higher than they have done since April, 1774, and even for that date I have only a record from one particular spot, where the effect may possibly have been local. Moreover, I have no record of the water running from Candown beyond Tilshead twice in one winter season, as it did this year in January and again in the fourth week of February.

F. J. WARDALE.

Shrewton, Wilts., 7th March, 1915.

MUSICAL SNOWFLAKES.

I READ with great interest the importance which is attached to the want of information as to the depth of snow in this country.

I wonder if any of your readers have ever observed during a snow storm, when the air is absolutely calm, that the large flakes in certain conditions, when falling, cause a musical sound. I am doubtful if it is imagination or a fact that the dry flakes falling cause this. Perhaps some of those interested in the larger question of snow would give their experiences.

H. H. GIBSON.

Fernhill, Belfast, February 24th, 1915.

THE LIMITS OF THE SEASONS.

I HAVE read in the last month or two in your magazine proposals in regard to the Seasons, suggesting changes of the months which are to be considered as Spring, Summer, Autumn, and Winter. The point is whether we are to consider the matter from an astronomical or a meteorological position. That at the Winter solstice we have the shortest day and the greatest gloom is true, and the strongest twilight at the Summer solstice is also true, but this is not meteorology, in which the temperature of individual months should not be considered, but rather the general conditions. On the average of years at Greenwich the greatest heat comes in the middle of July, that of August is nearly equal, and in June it is less than both. Also in Winter the lowest temperature comes in the first week of January, remaining with small variation to the commencement of February before definite rise begins. Meteorology has great variations in different years, but take any twenty years

there is no doubt that the highest and lowest temperatures of the year occur as above stated. In the case of snow the preponderance is undoubtedly in the first three months of the year, as compared with the last three months of the year, being rare in November, and still more so in October. Again March is not the middle of Spring, and September is not the middle of Autumn. So taking March, April, May, as representing Spring, June, July, August, as representing Summer, September, October, November as representing Autumn, and December, January, February, as representing Winter, we seem to have a natural division of the months, in which the Summer and Winter maximum and minimum of temperature of the year distinctly follow the solstice by nearly a month. As regards Spring and Autumn the Equinox cannot be said to be respectively the middle of either, which falls later in both cases. Equal division of the months seems best to represent the Seasons of the English climate. In other countries in parts of the Continent, or in Canada, the Spring is short. That is to say equal division into Seasons does not apply. One rather unexpected result in regard to the month of May was that I also found the average proportion of sunshine in that month, during my time at Greenwich, to be greater than that of either June or July, but I do not know whether this was maintained in following years.

WILLIAM ELLIS.

March 27th, 1915.

FORECASTING WEATHER BY MEANS OF CORRELATION.

Is not Mr. Dines a little unfair to correlation in his letter on page 30 of your March Magazine. By a "pure guess" at to-morrow's temperature, I take him to mean a "statement" of the normal temperature at that time of year. The actual temperature will differ from the normal temperature by about 6° F. in one case out of three. (The 6° F. is probably too low a value for day temperature at an inland station for the winter at any rate; it is also different for temperatures above the normal from what it is for temperatures below the normal); but accepting the figure, the normal day temperature at Kew Observatory, on April 15th, is about 55° F., and if I "guess" 55° I shall be no more than 6° F. wrong once out of every three "guesses." If, however, I know that on April 14th the temperature is 65° F., and using Mr. Dines' factor of ·80 I guess t = 63° F. for the temperature on April 15th, then I take Mr. Dines to mean that in one such case out of three, the actual temperature t would differ from 63° F. by more than 3°·6 F. But that does not make my forecast better than the "pure guess" only in the ratio 6 to 3·6, or 10 to 6. I have implicitly forecasted

a relatively warm day, and the day will nearly always be relatively warm.

The value of a forecast of temperature does not depend only on the difference of the actual from the forecasted temperature. The following example, purely hypothetical, illustrates this :

In March the normal night temperature is never below freezing point in London ; it costs me £x every night to take precautions to save me from £y damage by frost. If I act on the "pure guess," either I never take precautions or what is more probable, I remember the deviations and always take precautions and spend £ax to save £ay. Thus my gross profits are £$a(y—x)$.

But if I have a correlation co-efficient which tells me that a night will probably have a temperature below the normal, I take precantions and I do this, say, on n nights. On m other nights I do not take precautions and save £mx ; but naturally on some of these occasions, say p, I lose £py. If I can make $mx > py$, I shall benefit by the correlation and that is clearly possible.

If, for example, we take 5° F. and 4° F. as the figures for the pure guess and the correlated forecasts corresponding with Mr. Dines' 6° F. and 3°·6 F. ; then, whenever the forecast says "temperature 36° or below," I shall take precautions and in only a few cases will my precautions have been unnecessary. If the forecast says above 36°, I shall not take precautions, and in less than $\frac{1}{6}$ of these cases would precautions have been required. We may take on the average half the forecasts above and half below 36°, say 15 of each. Thus I shall save at least £15x, and at the worst lose £3y, and my gross profits are increased by 15x—3y. Previous to using correlation I could just pay the expenses of my establishment ; now I am happily in possession of a comfortable income of which the ratio 5/4 can convey no adequate impression.

E. GOLD.

7th April, 1915.

THE SEASONS—RECURRING COLD PERIODS.

THE correspondence on this subject will lead most of us to interesting reflections and many differences of opinion will be expressed.

It seems to me, briefly, that the division authorised by the International Meteorological Committee is the best that can be generally adopted. There are objections, no doubt, but it has significant conveniences and falls into natural accordance with the temperature of ordinary seasons. The alternative suggestions that have been made appear open to more serious opposition, though they each have something to recommend them. Try how we may, we cannot bring the weather into harmony with any arbitrary apportionment of the calendar. Occasionally there must occur

glaring inconsistencies. The obvious thing to do is to adopt that arrangement which most nearly and easily responds to the requirements, and this I believe is found in the even tri-monthly periods favoured by the Meteorological Committee.

In Luke Howard's "Climate of London," first Edition, 1818, he gives seasons as follows, and their temperatures :—

Winter	begins	December	7th,	lasts	89	days, temp.	37°·76
Spring	„	March	6th,	„	93	„ „	48°·94
Summer	„	June	7th,	„	93	„ „	60°·66
Autumn	„	September	8th,	„	90	„ „	49°·37

On looking through the average daily temperatures for Greenwich, 1841-1905, given in Whitaker's Almanack for 1915, I was struck with their irregular variations. From such a long series—65 years—one would have inferred a pretty even curve in the rising and falling of the thermometer readings, from winter to summer, and summer to winter respectively, but there are remarkable oscillations.

I find there are well defined cold periods.

February 7th—12th.	June 6th—11th.
March 6th—12th.	October 7th—13th.
„ 18th—21st.	November 6th—12th.
April 7th—11th.	December 16th—23rd.

Declines of temperature apparently occur in a striking manne in the second week of six of the months, and with a mean date on about the 9th or 10th day. This fact appears to me to possess a special significance, and can hardly be regarded as a chance result.

The temperatures apparently, give no countenance to the idea of "St. Martin's Little Summer," on or about November 11th, for the increase of cold appears very decided and to be unchecked during the first half of November.

In *Astronomische Nachrichten*, for 1839, No. 385, Prof. Erman stated that the cold days of the 11th to 13th of May, and the 5th and 7th of February, were owing to the passage of falling stars between us and the sun.

I cannot find that the May cold has been corroborated since Erman's investigation, though the February period has recurred at a slightly later date. Is there a meteoric swarm with a periodic time of about 30½ days, and sufficiently distended to occupy about six days in passing the sun, revolving around that luminary at little inclination, but with the necessary density to moderate the solar rays in an appreciable degree? Possibly the corona might have afforded evidence during past total eclipses of the sun. This is a mere suggestion on imperfect data, but the matter may be worth further enquiry.

W. F. DENNING.

Bristol, February 16th, 1915.

RAPID RISE IN A CHALK WELL.

As, judging by the correspondence I have received, my observations on the Well at Chelsham have aroused considerable interest. I think you may like to publish their continuation to March 9th.

Date.	JANUARY. Depth to Water from Surface.	Daily Rain-fall.	FEBRUARY. Depth to Water from Surface.	Daily Rain-fall.	MARCH. Depth to Water from Surface.	Daily Rain-fall.
	ft.	in.	ft.	in.	ft.	in.
1 ...	109	·64	85	·19	56½	·04
2 ...	105	·14	85	·21	57	·35
3 ...	..	·32	85	...	58	·06
4 ...	98	·18	85½	...	58½	...
5 ...	96	·02	85½	·48	59	...
6 ...	94	·50	86	·08	60	...
7 ...	92	·61	...	·54	...	...
8 ...	90	·08	86½	·85	61	...
9 ...	87	·01	86	·09	63	...
10 ...	...	·35	83	...		
11 ...	80	·01	79	...		
12 ...	78	·08	77	·08		
13 ...	77	...	75	·90		
14 ...	77	·02	...	·07		
15 ...	77	·19	72	...		
16 ...	77	...	71	·58		
17 ...	...	·01	69	·55		
18 ...	77	...	67	·13		
19 ...	79	...	64	·20		
20 ...	79	·32	61	...		
21 ...	81	·15	...	·07		
22 ...	81	1·00*	57	·06		
23 ...	81	...	56½	·24		
24 ...	...	...	56	...		
25 ...	81	...	55½	...		
26 ...	83	...	55½	·09		
27 ...	83½	...	56	·07		
28 ...	84	...	...	·06		
29 ...	84½	...				
30 ...	85	·05				
31 ...	...	·02				
		4·70		5·54		

* Snow.

The Bourne broke out at the Rose and Crown in the Kenley Valley on February 2nd, and is now flowing strongly as high up the valley as the Lodge to Marden Park, just to the east of the viaduct on the Oxted and East Grinstead Railway, about 1½ miles below the Well at which the foregoing observations were taken. The underground water gradient between these two points is about 39 feet per mile. The average gradient between the Well and the Springs at Croydon is now about 34 feet per mile, compared with about 16 feet per mile in November last, when the water in the Well reached its lowest level.

W. VAUX GRAHAM.

5, *Queen Anne's Gate, Westminster, S. W., March 10th*, 1915.

CORSICA IN MAY.

By Rev. R. P. Dansey.

In May last Mr. V. H. Gatty made an expedition to Corsica and kindly asked me to accompany him. Some notes on the meteorological features of that island may not be without interest to your readers.

Most of our stay was spent at the Col Vizzavona (3,800 ft.), situated in the midst of a beech forest which was already green when we arrived on the 3rd, though some of the trees were not in their full foliage; this beech forest goes up to a height of about 5,000 ft., but had not come out much above 4,200 ft.

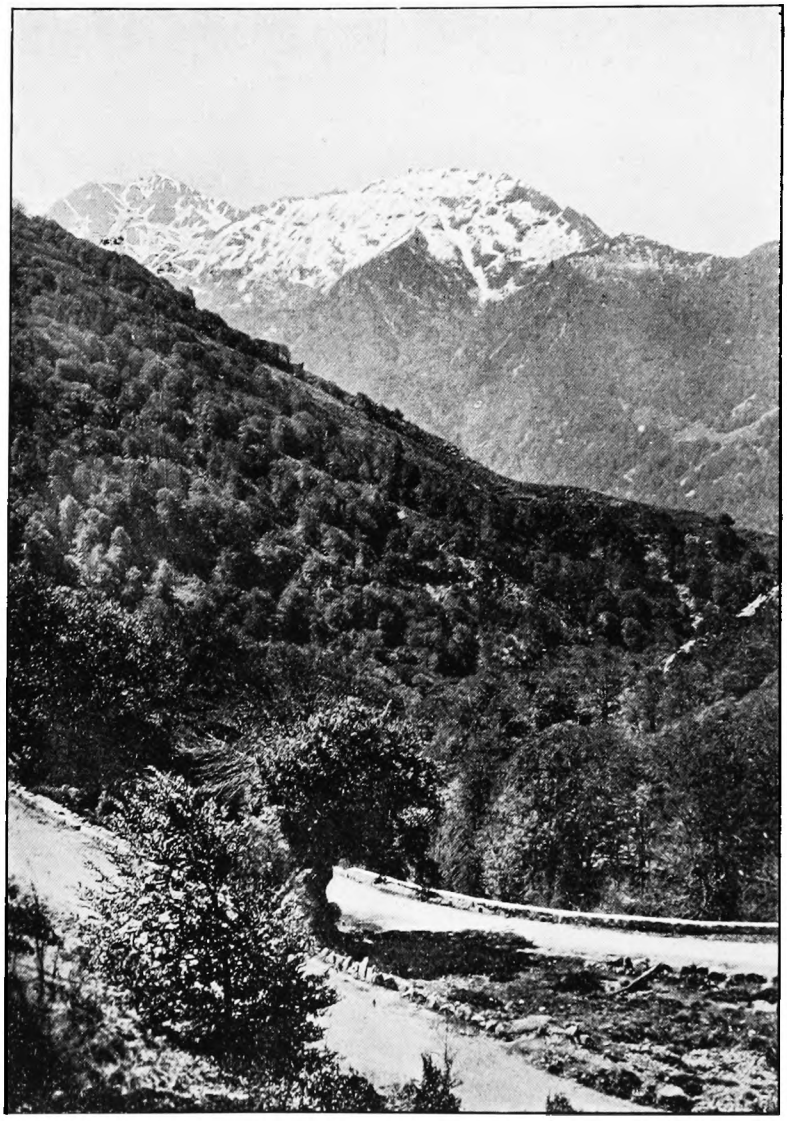
The Col Vizzavona is almost in the centre of the island and is on the main range of mountains and perhaps as wet as any place in Corsica. At any rate rain fell more or less continuously for 60 hours, from the 8th to 10th, with a max. temp. of only 40°·5 on the latter day. After the first day's rain we conceived the idea of trying to measure it in a tin requisitioned from the kitchen. During the second twenty-four hours we collected $1\frac{3}{4}$ ins. The rain for that period had slackened appreciably and we calculated that 4 to 5 ins. must have fallen in the 60 hours. The fall was snow above 4,500 ft. or so, and lay above 5,400 ft. The temperature at Vizzavona was seldom above 56°. There had been 5 ft. of snow here for two months in the winter, and certainly as regards this winter (1913-1914), more snow seems to have fallen in Corsica than at the same height in England, although it is 800 miles further south. Certainly if our own Snowdon had been 200 ft. higher, to equal the Col Vizzavona, it would not have carried so much snow as did the latter place.

A peculiar feature at Vizzavona was that the finer and more sunny the day, the more certain were the mountain peaks to condense cloud between 9 and 10 a.m. each day, and to keep enveloped all day till sunset, when it would become absolutely clear again. This went on as regularly as clock-work, with light airs from W. or S.W. On May 19th we reached the top of Monte D'Oro (7,842 ft.) at 10 a.m. on a morning which had been cloudless, but the usual cloud formation enveloped the mountain just before we attained the summit, and though we waited for a view till 2.40 p.m., it was all in vain. There was no wind, temperature 40°-42°, and light showers of graupel and snow. At sunset the whole sky cleared, as usual.

The snow level on the north slopes was about 6,000 ft., though it descended in places to as low as 5,200 ft., and though no mountains reach the snow-line, the highest, Cinto, being just under 9,000 ft., there must be several peaks with permanent snow-beds, some of them in all probability more approximating to a small glacier than a snow-bed.

Eagles are numerous round Vizzavona; on one occasion while

resting alone on the top of one of the lower heights one of these birds came swooping down apparently straight for me. When he had got within about 100 ft. or so I thought it was about time to



PUNTA VETTA FROM ABOVE COL VIZZAVONA.

move, so stood up and whirled my ice-axe whereupon he made off. The month before our arrival two young eagles had actually found their way into the hotel, but had effected their escape.

On May 21st we left Vizzavona, and this day the wind got into the north-east, and it became much hotter and drier, while the peaks remained clear all day and never condensed any vapour round their summits, though the atmosphere was hazy, as it is in England in hot summer weather with easterly breezes.

The highest temperature noted was over 80° at Corte (inland) on the 21st; the same evening it was 70° in the rock-bound Golo Gorge an hour after sunset, when quite dark. Lowest 32° on Monte Incudine (7,200 ft.) at 6 a.m. on 16th.

The temperature of the sea was 70° off the west coast (in the Gulf of Sagone) on the 24th. I shall never forget this, as being the most delightful—as well as most-needed—bathe I have ever had.

It is so hot and unhealthy on the east coast in the height of the summer that one town—Aleria—has to be completely evacuated for three months. The forests are magnificent; above the beeches come the pines and some of these giants run up to 80 or 100 feet without any appreciable diminution in girth, while some of the mountain peaks are exceptionally grand and rugged.

No snow ever lies at Ajaccio (sea-level), but it does so most winters at 2,000 ft, for a day or two at a time.

For those who desire further information about this beautiful island—which possesses good roads over mountain passes and very little traffic—a paper by Mr. V. H. Gatty has just appeared in the February number of the Alpine Journal. June is probably the best month to visit the country, anyway for mountain excursions.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of the Society was held on March 17th, at the Surveyors' Institution, Westminster; Captain H. G. Lyons, F.R.S., President, in the chair.

Following the custom of the Society a lecture bearing on a subject connected with Meteorology, but not essentially meteorological, is delivered by invitation of the Council at the Spring Meeting. On this occasion Dr. W. G. Duffield, Professor of Physics at University College, Reading, dealt with the Meteorology of the Sun; that is to say, with the movements which take place in the solar atmosphere. He showed that by means of the spetroscope it was possible not only to detect the existence of all the known elements in a state of incandescent vapour in the solar atmosphere, but also to ascertain their distribution and relative movements.

Thus the constitution and circulation of the sun's atmosphere has been traced out irrespective of the ocular evidence afforded by the appearance of sun-spots and prominences and in recent years great advances have been made in determining the strati-

fication of the photosphere. Dr. Duffield pronounced solar meteorology to be in some respects more simple than terrestrial, and showed that it was possible to draw trajectories of the elements of solar whirls and sunspots by actual observations, while such a study of cyclonic depressions in the earth's atmosphere can only be carried out indirectly by reference to records of barometric pressure and winds long after the phenomena had passed. The lecturer concluded with a plea for further research into the relationships between solar and terrestrial phenomena which are of equal value and interest both to meteorologists and physicists.

Dr. H. R. Mill, in proposing a vote of thanks, congratulated Dr. Duffield upon the luminous manner in which he had treated the source of light. Lieut.-Col. Mellish seconded the vote of thanks which was put by the Chairman and carried by the largest audience which we remember to have sseen at one of these meetings.

METEOROLOGICAL NEWS AND NOTES.

The Royal Geographical Society has awarded the Victoria Gold Medal for Geographical Research to Dr. H. R. Mill, for his investigations and writings on geographical subjects, including Oceanography and the Cartographic Study of Rainfall.

Dr. Martin Gil, of Cordoba, has, we understand, from private correspondence, been appointed Direction of the Argentine Metorological Office, in succession to Mr. Walter G. Davis, whose long labours for the Argentine Government have brought the Weather Service of Argentine to a completeness and efficiency second only to that of the United States, and the Great Countries of Europe.

The Argentine Meteorological Station in the South Orkneys, founded by Dr. Bruce's Antarctic Expedition in the *Scotia*, is being continued and the *Geographical Journal* announces that a party of meteorologists left Buenos Aires in January to relieve those who had spent the previous year on Laurie Island. The new party is under the charge of Mr. H. Basche-Wiig.

The death of Mr. Frank T. Bullen, the famous author of experience and tales of the sea, recalls the fact that from 1883 to 1899, sixteen years, he was a clerk in the Marine Department of the Meteorological Office. His earlier experiences of fourteen years afloat in all capacities, from ship's boy to chief mate, gave him the first hand data which his literary skill enabled him to put before the world the unique series of word pictures of modern sailing ship life.

INTERNATIONAL BALLOON ASCENTS.

By W. H. DINES, F.R.S.

January 3rd, 1912.

Starting Point.	Country.	A (He) miles	B (Te) ° F.	C miles.	D ° F.	E miles.	F
Brussels	Belgium ..	7·8	—78	10·6	—76	86	S.E.
Hamburg	Germany..	6·6?	—82	8·0?	—71	115	E.S.E.
Strassburg	„ ..	7·6	—80	8·8	—76	64	S.E.
Vienna.....	Austria....	6·2	—85	6·6	—78	75	S.S.E.
Pavlowsk.....	Russia	5·1	—68	6·0	—60	37	S.E.

January 4th, 1912.

Brussels	Belgium ..	7·7	—89	9·2	—80	86	S.E.
Hamburg.....	Germany..	6·8	—83	10·7	?	135	S.E.
Strassburg.....	„ ..	7·4	—79	7·5	—77	67	?
Pavlowsk.....	Russia	5·2	—76	6·0	—67	50	S.S.E.
Nizhni Olchedaeff	„	5·8	—63	6·0	—63	71	E. by S.
Ekaterinburg....	Siberia....	5·0	—71	6·3	—65	155	E.N.E.

January 5th, 1912.

Manchester	England ..	6·7	—70	7·4	—65	132	S.E. by E.
Brussels	Belgium ..	6·5	—85	9·5	—83	114	E.
Hamburg.....	Germany..	6·6	—60	7·2	—60	95	E.
Lindenberg.....	„	6·8	—81	8·8	—75	109	E.S.E.
Paris.....	France....	7·0	—78	11·2	—69	418	E.
Strassburg	Germany..	7·3	—92	8·4	—79	69	E.
Munich	„ ..	7·1	—86	7·5	—86	63	E.S.E.
Vienna.....	Austria ..	5·9	—89	6·9	—87	101	E.S.E.
Pavlowsk.....	Russia	5·1	—71	5·9	—71	47	S.E. by E.

A Height in miles of commencement of isothermal column.
B Temperature, F°., at bottom of column.
C Greatest height of reliable record in miles.
D Temperature, F°., at greatest height.
E Distance in miles of point where balloon fell
F Bearing of falling point from starting point

This series of ascents seems to have been particularly unfortunate. Four balloons were sent up from Pyrton Hill, and three from Pavia, and none of them were found. Among those found, in many instances the clock stopped or the record failed, and of the remainder many heights were less than six miles.

During the three days very great changes of pressure occurred. A depression passed in from N.W. to S.E., and on the 4th all the East of Europe was covered by a low pressure area. On the next day this united with a new depression that was coming in from Iceland. There seems to have been a greater drift of the balloons than usual to the east and south-east, and it is probable that most or all of the balloons from Pyrton Hill fell in the Channel.

RAINFALL TABLE FOR MARCH, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	1·70	·86
Tenterden	*Kent*	51 4	*0 41	190	1·95	·81
Arundel (Patching)	*Sussex*	50 51	0 27	130	1·95	·91
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·17	·95
Oxford (Magdalen College).	*Oxfordshire*	51 45	1 15	186	1·45	1·20
Wellingborough(Swanspool)	*Northampton*	52 18	0 41	155	1·72	1·17
Shoeburyness	*Essex*	51 31	*0 48	13	1·19	·88
Bury St. Edmunds(Westley)	*Suffolk*	52 15	*0 40	226	1·71	1·72
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	1·57	1·73
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	2·74	·64
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·30	·98
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·01	1·29
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·19	·71
Boston	*Lincolnshire*	52 58	0 1	11	1·47	1·25
Worksop (Hodsock Priory).	*Nottinghamshire*	53 22	1 5	56	1·70	·99
Mickleover Manor	*Derbyshire*	52 54	1 32	280	1·69	1·01
Macclesfield	*Cheshire*	53 15	2 7	501	2·50	1·62
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	2·11	1·26
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	5·17	1·48
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	1·92	1·12
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	1·84	1·37
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·10	2·31
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	10·63	5·28
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	2·89	1·44
Haverfordwest	*Pembroke*	51 48	4 58	90	3·16	·93
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	3·04	1·93
Llandudno	*Carnarvon*	53 20	3 50	72	2·13	·64
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	3·33	1·90
Marchmont House	*Berwick*	55 44	2 24	498	2·64	2·13
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	3·62	2·45
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	2·61	1·03
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	5·41	4·83
Mull (Quinish)	,,	56 34	6 13	35	4·28	4·11
Dundee(EasternNecropolis)	*Forfar*	56 28	2 57	199	2·06	1·43
Braemar	*Aberdeen*	57 0	3 24	1114	2·87	1·82
Aberdeen (Cranford)	,,	57 8	2 7	120	2·65	2·18
Gordon Castle	*Moray*	57 37	3 5	107	2·36	3·47
Fort Augustus(S. Benedict's)	*E. Inverness*	57 9	4 41	68	3·79	1·63
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	7·29	6·02
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·64	2·89
Wick	*Caithness*	58 26	3 6	77	2·24	2·01
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	4·51	1·08
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	2·64	1·38
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	2·99	·87
Ennistymon House	*Clare*	52 57	9 18	37	3·24	1·39
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·28	·97
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·59	1·06
Dublin(FitzWilliamSquare)	*Dublin*	53 21	6 14	54	1·98	1·10
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	2·64	·90
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	4·36	1·64
Cong (The Glebe)	,,	53 33	9 16	112	3·80	1·24
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·33	1·06
Seaforde	*Down*	54 19	5 50	180	2·84	1·26
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	2·73	1·46
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	2·98	1·59

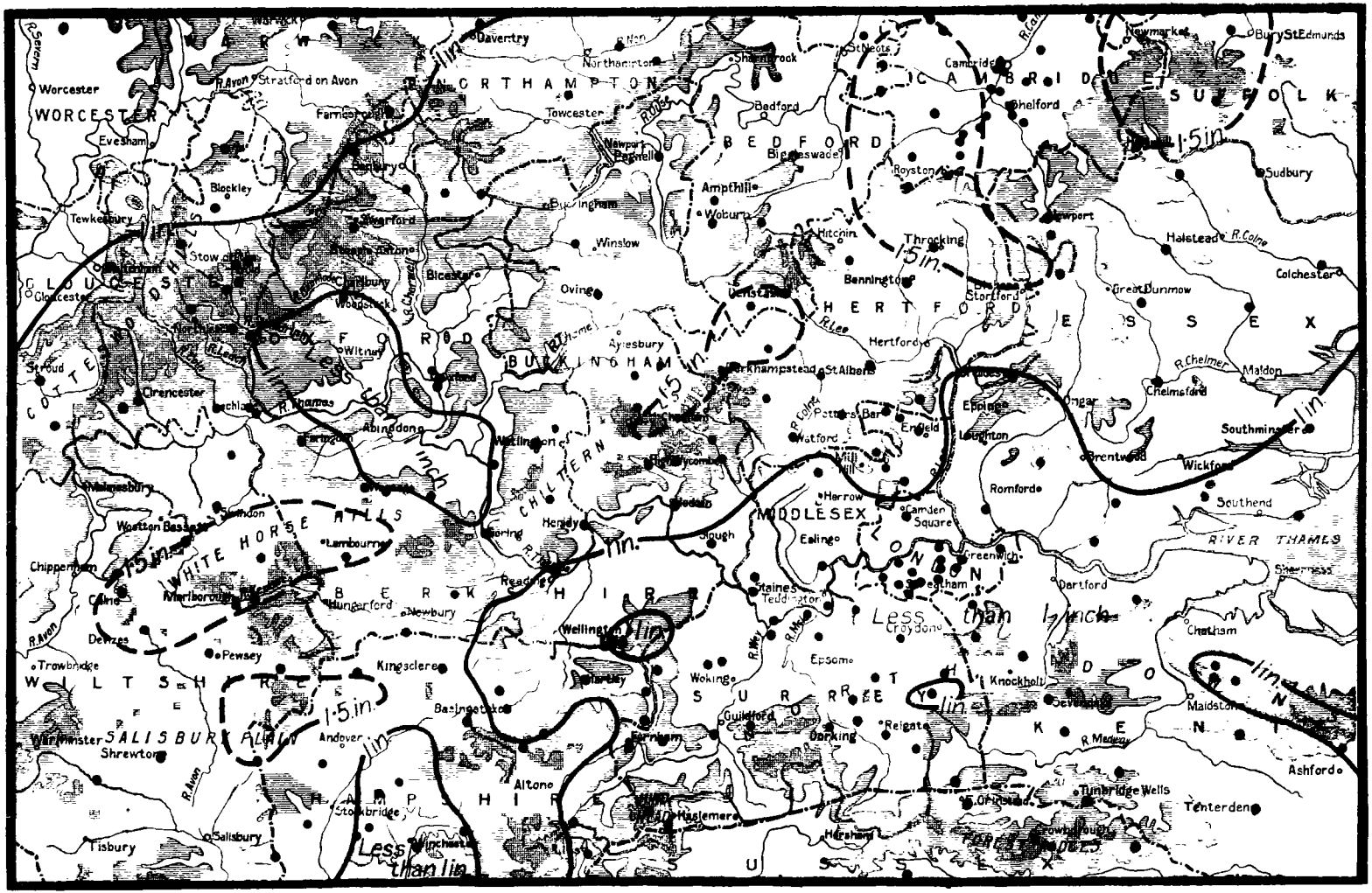
RAINFALL TABLE FOR MARCH, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875–1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875–1909. in.	STATION.
— ·84	51	·25	2	12	5·19	8·40	+3·21	162	25·11	Camden Square
—1·14	42	·20	2	12	5·99	8·44	+2·45	141	27·64	Tenterden
—1·04	47	·26	2, 23	9	6·71	10·46	+3·75	156	30·48	Patching
—1·22	44	·22	2	9	7·20	10·58	+3·38	147	31·87	Cadland
— ·25	83	·50	22	12	4·85	7·12	+2·27	147	24·58	Oxford
— ·55	68	·30	22	12	5·32	5·96	+ ·64	112	25·20	Swanspool
— ·31	74	·13	2	14	3·71	4·45	+ ·74	120	19·28	Shoeburyness
+ ·01	101	·35	18	16	5·00	7·14	+2·14	143	25·40	Westley
+ ·16	110	·33	24	17	4·51	8·05	+3·54	178	23·73	Geldeston
—2·10	23	·14	10	10	9·28	14·52	+5·24	156	38·27	Polapit Tamar
—1·32	43	·50	22	7	7·74	9·98	+2·24	129	33·54	Rousdon
— ·72	64	·55	23	9	6·46	8·84	+2·38	137	29·81	Stroud
—1·48	32	·33	2	8	6·87	10·83	+3·96	158	32·41	Wolstaston
— ·22	85	·28	7	16	4·54	5·95	+1·41	131	23·35	Boston
— ·71	58	·30	18	12	5·04	5·81	+ .77	115	24·46	Hodsock Priory
— ·68	60	·28	22	14	5·35	6·15	+ ·80	115	26·65	Mickleover
— ·88	65	·26	5	15	7·46	10·95	+3·49	147	34·73	Macclesfield
— ·85	60	·33	2	12	6·73	8·79	+2·06	131	32·70	Southport
—3·69	29	·30	2	7	16·31	21·27	+4·96	130	61·49	Arncliffe
— ·80	58	·28	18	6	5·52	8·00	+2·48	145	26·87	Ribston Hall
— ·47	74	·52	18	15	5·32	7·63	+2·31	143	26·42	Hull
+ ·21	110	1·08	18	16	5·63	7·03	+1·40	125	27·94	Newcastle
—5·35	50	1·33	6	14	35·03	42·47	+7·44	121	129·48	Seathwaite
—1·45	50	·39	2	11	9·61	11·02	+1·41	115	42·28	Cardiff
—2·23	29	·29	2	8	11·27	14·02	+2·75	124	46·81	Haverfordwest
—1·11	64	·66	2	10	10·04	14·95	+4·91	149	45·46	Gogerddan
—1·49	30	·18	5	12	6·75	7·77	+1·02	115	30·36	Llandudno
—1·43	57	·60	18	13	10·85	16·53	+5·68	152	43·47	Cargen
— ·51	81	·47	27	14	7·19	7·35	+ ·16	102	33·76	Marchmont
—1·17	68	·65	2	16	12·27	17·48	+5·21	143	49·77	Girvan
—1·58	39	·19	24	14	8·84	7·83	—1·01	89	35·97	Glasgow
— ·58	89	1·43	4	15	18·46	22·08	+3·62	120	68·67	Inveraray
— ·17	96	1·26	4	20	14·28	17·94	+3·66	126	56·57	Quinish
— ·63	69	·38	17	13	5·98	7·85	+1·87	131	28·64	Dundee
—1·05	63	·54	23	16	8·34	13·19	+4.85	158	34·93	Braemar
— ·47	82	·45	17	18	7·37	9·73	+2·36	132	32·73	Aberdeen
+1·11	147	·79	5	23	6·30	8·87	+2·57	141	30·34	Gordon Castle
—2·16	43	·23	25	15	13·57	9·25	—4·32	68	44·53	Fort Augustus
—1·27	83	1·14	4	23	24·24	25·21	+ ·97	104	83·93	Bendamph
+ ·25	109	·50	6	17	7·97	...	...	...	31·90	Dunrobin Castl
— ·23	90	..	...	...	6·95	6·67	— ·28	96	29·88	Wick
—3·43	24	·27	3, 22	14	15·44	16·48	+1·04	107	54·81	Killarney
—1·26	52	·56	22	9	9·60	9·05	— ·55	94	39·57	Waterford
—2·12	29	·40	2	8	9·76	11·12	+1·36	114	39·43	Castle Lough
—1·85	43	·44	2	16	10·98	14·38	+3·40	131	46·52	Ennistymon
—1·31	42	·42	22	7	8·22	8·58	+ ·36	104	34·99	Courtown Ho.
—1·53	41	·46	2	10	8·29	9·37	+1·08	113	35·92	Abbey Leix
— ·88	56	·53	22	13	6·05	6·48	+ ·43	107	27·68	Dublin
—1·74	34	·20	1	14	8·41	11·28	+2·87	134	36·15	Mullingar
—2·72	38	·33	2	20	13·91	15·04	+1·13	108	52·87	Enniscoe
—2·56	33	·49	2	11	12·31	13·55	+1·24	110	48·90	Cong
—2·27	32	·30	2	16	10·40	12·68	+2·28	122	42·71	Markree
—1·58	44	·25	22	14	9·06	9·80	+ ·74	108	38·91	Seaforde
—1·27	53	·24	2	18	8·48	7·15	—1·33	84	37·56	Dundarave
—1·39	53	·37	2	15	9·12	10·34	+1·22	113	39·38	Omagh

SUPPLEMENTARY RAINFALL, MARCH, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	·73	XI.	Lligwy	·72
,,	Ramsgate	1·13	,,	Douglas	1·91
,,	Hailsham	·83	XII.	Stoneykirk, Ardwell House...	2·31
,,	Totland Bay, Aston House...	·79	,,	Carsphairn Shiel	2·78
,,	Stockbridge, Ashley..	1·03	,,	Beattock, Kinnelhead	2·16
,,	Grayshott	·76	,,	Langholm, Drove Road	3·02
III.	Harrow Weald, Hill House...	·94	XIII.	Meggat Water, Cramilt Lodge	1·20
,,	Caversham, Rectory Road ...	1·00	,,	North Berwick Reservoir.....	1·14
,,	Pitsford, Sedgebrook...	1·03	,,	Edinburgh, Royal Observaty.	1·14
,,	Woburn, Milton Bryant.....	1·28	XIV.	Maybole, Knockdon Farm ...	1·54
,,	Chatteris, The Priory..... ...	1·20	XV.	Ballachulish House	7·36
IV.	Elsenham, Gaunts End	1·50	,,	Campbeltown, Witchburn ..	2·35
,,	Colchester, Hill Ho., Lexden	1·14	,,	Holy Loch, Ardnadam.....	5·03
,,	Ipswich, Rookwood, Copdock	1·42	,,	Islay, Eallabus	3·02
,,	Blakeney..... . ..	1·38	,,	Tiree, Cornaigmore	3·39
,,	Swaffham	1·50	XVI.	Dollar Academy	2·85
V	Bishops Cannings	1·59	,,	Balquhidder, Stronvar.....	...
,,	Wimborne, St. John's Hill...	·86	,,	Glenlyon, Meggernie Castle..	3·20
,,	Ashburton, Druid House.. ...	1·09	,,	Blair Atholl	1·84
,,	Cullompton	·87	,,	Coupar Angus	1·49
,,	Lynmouth, Rock House	·69	,,	Montrose, Sunnyside Asylum.	1·22
,,	Okehampton, Oaklands.. ...	·87	XVII.	Alford, Lynturk Manse	2·04
,,	Hartland Abbey.....	·88	,,	Fyvie Castle	3·07
,,	Probus, Lamellyn.....	·77	,,	Keith Station	3·34
,,	North Cadbury Rectory.	1·12	XVIII.	Rothiemurchus	2·41
VI.	Clifton, Pembroke Road.....	1·37	,,	Loch Quoich, Loan	14·20
,,	Ross, The Graig	·71	,,	Drumnadrochit..... ..	2·67
,,	Shifnal, Hatton Grange.....	1·02	,,	Skye, Dunvegan	5·16
,,	Droitwich.....	·67	,,	Lochmaddy, Bayhead	3·58
,,	Blockley, Upton Wold.....	·97	,,	Glencarron Lodge	8·63
VII.	Market Overton.....	1·51	XIX.	Invershin	2·66
,,	Market Rasen	·91	,,	Melvich	3·64
,,	Bawtry, Hesley Hall	1·12	,,	Loch Stack, Achfary	7·95
,,	Derby, Midland Railway.....	·98	XX.	Dunmanway, The Rectory ..	1·48
,,	Buxton	...	,,	Glanmire, Lota Lodge.....	·70
VIII.	Nantwich, Dorfold Hall	1·56	,,	Mitchelstown Castle.....	·94
,,	Chatburn, Middlewood	2·25	,,	Darrynane Abbey.....	1·22
,,	Lancaster, Strathspey	1·88	,,	Clonmel, Bruce Villa	·90
IX.	Langsett Moor, Up. Midhope	·94	,,	Newmarket-on-Fergus, Fenloe	1·27
,,	Scarborough, Scalby	1·93	XXI.	Laragh, Glendalough	·61
,,	Ingleby Greenhow	2·05	,,	Ballycumber, Moorock Lodge	·68
,,	Mickleton	1·70	,,	Balbriggan, Ardgillan	·76
X.	Bellingham, High Green Manor	2·03	XXII.	Ballynahinch Castle.....	1·95
,,	Ilderton, Lilburn Cottage ...	1·83	,,	Woodlawn	1·05
,,	Keswick, The Bank.....	2·29	,,	Westport, St. Helens	1·01
XI.	Llanfrechfa Grange	1·22	,,	Dugort, Slievemore Hotel ...	1·90
,,	Treherbert, Tyn-y-waun	3·13	,,	Mohill Rectory	·84
,,	Carmarthen, The Friary	1·35	XXIII.	Enniskillen, Portora.....	1·34
,,	Fishguard Goodwick Station.	·91	,,	Dartrey [Cootehill]	1·07
,,	Crickhowell, Tal-y-maes.....	1·20	,,	Warrenpoint, Manor House ..	·76
,,	New Radnor, Ednol	1·60	,,	Banbridge, Milltown	·65
,,	Birmingham WW., Tyrmynydd	1·85	,,	Belfast, Cave Hill Road	1·24
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	1·45
,,	Llangynhafal, Plâs Draw.....	·98	,,	Londonderry, Creggan Res...	1·74
,,	Dolgelly, Bryntirion.....	3·79	,,	Dunfanaghy, Horn Head ...	1·95
,,	Bettws-y-Coed, Tyn-y-bryn...	...	,,	Killybegs	3·33

THAMES VALLEY RAINFALL —— MARCH, 1915.



THE WEATHER OF MARCH.

In the first week of the month the conditions were unsettled with frequent rain though the precipitation was not generally heavy, except in Scotland and the north-west of England. On the 1st thunderstorms occurred over practically the whole of the southern half of Great Britain and in many places were accompanied by snow. A depression of some intensity which moved across the northern part of the Kingdom, from the Atlantic, caused heavy rain in the west of Scotland on the 4th, many stations having more than 1·50 in. At Ballachulish House there was as much as 3·11 in., at North Ballachulish 2·61 in., and at Glencarron 2·46 in. About an inch also fell at these stations on the 5th. A large anticyclonic system spread over the Kingdom on the 8th and a general improvement in the weather set in. Temperature rose in most districts on the 10th. On the 12th the shade maxima reached 61° at Crieff, on the 13th 62° at Alnwick Castle and 60° at Hereford, and on the 14th 60° or 61° occurred at several stations in the north of England and in Scotland, and 55° generally south of the Tweed and in the north of Ireland. On the 17th a disturbance appeared over the central part of Great Britain, causing gales in the northern half of the Kingdom and a sudden and considerable fall in temperature. Snow fell heavily over the whole of the eastern half of Great Britain and caused much damage in some places. At Geldeston the snow was preceded by unusual darkness from 7.30 to 9.30 a.m. At Macclesfield the depth was 5 inches with drifts 5 feet deep in places. In the southern counties of Scotland the depth was rather more. Trees were blown down at Mansfield and many sheep were smothered by the drifting snow on the hills around Hawick. In the Peak District, Northumberland, and Berwickshire railway communication was temporarily cut off. An anticyclone spread over the southern part of the Kingdom on the 20th and fine weather ensued with higher temperatures. A large depression passed up the Bay of Biscay in a northerly direction on the 22nd and 23rd and changeable conditions again set in. Occasional snow showers occurred in nearly all parts of the Kingdom, though the falls were never heavy. Severe frosts occurred daily in the last week over practically the whole of the British Isles. Between the 28th and 30th shade minima of 19° were recorded at Balmoral and Raunds, and 18° at Kilmarnock and Llangammarch Wells.

Except for a few small scattered areas along the east coast and in the north of Scotland, the rainfall of the month was everywhere below the average.

Practically the whole of the south-eastern Counties of England had less than an inch. In the accompanying map of the Thames Valley no isohyet so high as 2·00 in. appears, and over the whole of England and Wales only the mountain or moorland districts had more than this amount, a very exceptional circumstance. In Scotland less than 3·00 in. fell to the east of a line joining Inverness and Glasgow. The deficiency was greatest in Ireland, almost the whole of the central portion receiving less than an inch. At Killarney the total was only 24 per cent. of the average fall for March.

The duration of sunshine varied and in some places was considerable. The following amounts are reported: London (Camden Square), 80·0 hours; Margate, 96·0 hours; Worthing, 117·2 hours; Copdock, 93·2 hours; Weymouth, 140·8 hours; Ashbourne, 110·6 hours; Bolton, 65·0 hours; Haverfordwest, 144·3 hours; Paisley, 120·0 hours, and Loch Stack, 54·3 hours.

In London the conditions were generally cloudy with occasional bright sunny days. Temperature was low in the latter part of the month and the mean temperature, 42°·0, was 0°·1 below the average, this being the first occasion that the monthly mean temperature has been below the average since January, 1914. Duration of rainfall, 34·8 hours. Evaporation, ·66 in.

Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was as follows: England and Wales, 54; Scotland, 79; Ireland, 40; British Isles, 58.

Climatological Table for the British Empire, October, 1914.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity. (0-100)	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°		°	°	inches		
London, Camden Square	68·5	1	34·7	12	59·6	45·7	47·2	86	106·8	31·3	1·25	13	7·2
Malta	77·0	12	61·2	14	72·4	66·6	...	76	134·0	...	2·03	9	1·1
Lagos	88·3	31	71·0	3	86·3	75·8	73·7	78	161·4	68·0	4·25	14	7·2
Cape Town	84·3	28	49·3	27	71·9	55·6	54·1	70	...	...	·55	4	3·7
Natal, Durban ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	85·6	9	44·0	28	74·7	52·7	49·1	67	...	44·0	2·25	10	4·0
Mauritius	84·1	24	58·3	13	80·4	63·6	59·8	68	...	49·1	·69	16	5·6
Bloemfontein	89·3	22	41·0	2	80·2	54·4	47·1	51	...	...	1·11	5	2·4
Calcutta...	92·0	1	65·5	30	88·8	72·8	70·2	72	...	61·5	·32	1	3·2
Bombay...	94·2	22	75·9	18	90·9	78·6	74·3	73	140·8	65·5	·01	1	3·1
Madras	97·3	6	72·3	29	87·5	75·1	74·2	84	168·6	71·7	19·22	18	6·5
Colombo, Ceylon ...	89·9	19	72·2	8	86·2	73·8	74·7	84	162·0	70·3	16·02	29	8·5
Hongkong	85·4	7	66·5	22	81·2	74·3	69·6	77	...	...	6·45	17	6·5
Sydney	96·0	30	50·7	13	73·4	57·4	54·4	69	151·9	42·8	7·53	15	5·1
Melbourne	98·4	24	32·8	16	73·7	49·9	45·4	52	149·8	26·4	·29	6	4·0
Adelaide	102·2	24	43·7	12	81·9	57·2	46·7	37	157·6	33·0	·17	3	3·6
Perth	88·2	4	46·1	24	75·4	56·2	53·0	63	154·0	38·7	1·46	11	5·4
Coolgardie	96·6	4	46·0	24	81·1	56·7	46·7	41	160·4	45·0	1·70	7	5·0
Hobart, Tasmania ..	92·0	24	35·8	18	66·8	46·7	40·3	49	147·0	25·0	·39	6	5·0
Wellington ...	69·0	14*	38·8	4	61·3	49·9	46·3	71	138·0	26·4	1·54	8	6·2
Auckland	66·0	12	44·0	30	62·0	49·3	48·4	77	133·0	40·0	1·15	11	6·0
Jamaica, Kingston .	94·7	11	71·2	22	90·7	73·9	71·9	80	...	...	1·58	5	4·9
Grenada	90·0	27	73·0	22†	85·7	75·6	...	79	136·0	...	8·44	23	4·2
Toronto	79·2	21	26·0	27	61·4	44·1	45·6	86	126·7	23·9	1·54	10	4·0
Fredericton	76·8	5	13·0	28	57·6	35·5	...	78	...	...	3·09	8	4·8
St. John, N.B. ...	74·0	3	23·8	28	55·8	42·0	42·0	76	...	...	2·97	11	4·6
Alberta, Edmonton ...	68·0	14	23·1	28	53·7	32·9	...	77	118·5	17·8	1·08	8	5·7
Victoria, B.C.	67·0	14	42·0	22	58·0	47·5	...	90	...	...	2·58	12	7·0

* and 26. † and 23.

Johannesburg.—Bright sunshine 236·9 hours.

Mauritius.—Mean temp. 1°·1, dew point 1°·8, and R ·59 in., below averages. Mean hourly velocity of wind 10·9 miles.

COLOMBO, CEYLON.—Mean temp. 80°·0, same as average, dew point 0°·6 above, and R ·14 in. above, averages. Mean hourly velocity of wind 3·8 miles.

HONGKONG.—Mean temp. 77°·5, mean hourly velocity of wind 13·3 miles. Bright sunshine 192·5 hours.

Melbourne.—Mean temp. and mean daily maxima a record. R ·29 in., the lowest on record.

Adelaide.—Hottest and driest October on record. Mean max. + 9°·4. Mean min. + 5°·9. Mean temp. + 7°·7. R 1·58 in. below, averages.

Perth.—Mean temp. 5°·0, and R above averages.

Coolgardie.—Temp. 5°·3 above average.

Hobart.—Temp. 2°·7 above, and R 1·84 in. below, averages.

Wellington.—Mean temp. 1°·5 above, and R 2·67 in. below, averages. Bright sunshine 210 hours. H on 28th.

Auckland.—Dry, cool and cloudy month. R and temp. below averages.

ALBERTA, EDMONTON.—A warm month. R slightly above average.

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THE DIURNAL RANGE OF RAINFALL AT KARLSRUHE (BADEN) AND AT PETROGRAD.

By Henrik Renqvist, Helsingfors.

The Annual Reports of the Meteorological and Hydrographical Central Office in Karlsruhe (*Jahres-Bericht des Zentralbureaus für Meteorologie und Hydrographie im Grossherzogtum Baden*) contain, beginning from the year 1892, hourly amounts of the rainfall in the summer half-year at Karlsruhe. I have, for intervals of 4 hours, added these values for the summer months (June, July, and August) of the years 1892-1913 inclusive. We thus obtain a conception of the diurnal range, based on observations from 22 consecutive years, which form the longest similarly treated period I know of from the continent. The gauge employed was a Hottinger model until 1900 inclusive, from 1901 a Hellmann gauge was used.

The registered amounts for the whole period are :—

June, July, August ...	m. a.m. 12—4	a.m. 4—8	a.m. n. 8—12	n. p.m. 12—4	p.m. 4—8	p.m m. 8—12	
Karlsruhe (1892–1913) ...	732·3	687·0	585·0	946·3	1051·7	785·9	mm.

Hence, percentages of the total amount :—

15·3	14·3	12·2	19·8	22·0	16·4	%

The rainfalls registered at Petrograd were made out in the same way. Hourly amounts for all months are published each year in the *Annales de l'Observatoire Physique Central Nicolas*. The period is here considerably shorter, covering only 12 years (1897-1908). A Rohrdantz pluviograph was used all the time.

The amounts for intervals of four hours are :—

June, July, August ...	m. a.m. 12—4	a.m. 4—8	a.m. n. 8—12	n. p.m. 12—4	p.m. 4—8	p.m. m. 8—12	
Petrograd (1897–1908) ..	358·9	327·1	367·2	547·3	465·7	386·0	mm.

or, in percentage :—

14·6	13·3	15·0	22·3	19·0	15·7	%

We notice both Karlsruhe and Petrograd are fair representatives of the continental types, showing a maximum in the afternoon and a minimum in the morning, although the maximum and minimum at Karlsruhe occur some hours later than at Petrograd. The discrepancies may partly be caused by the non-identity of the periods considered.

It may be added, that Karlsruhe has a diurnal range highly resembling that of Perpignan, for which station we calculate the following percentages from Fines's data in the *Bulletin météorologic annuel du Département des Pyrénées Orientales*, xxix. :—

June, July, August ...	m. a.m. 12—4	a.m. 4—8	a.m. n. 8—12	n. p.m. 12—4	p.m. 4—8	p.m. m. 8—12
Perpignan (1884-1900) ...	13·5	13·5	12·9	19·6	23·9	16·6 %

On the other hand, Petrograd shows in this respect great similarity to Kew, for which station we obtain the following percentages :—

June, July, August ...	m. a.m. 12—4	a.m. 4—8	a.m. n. 8—12	n. p.m. 12—4	p.m. 4—8	p.m. m. 8—12
Kew (1871-1890) ...	13·4	13·1	14·9	21·5	20·2	16·8 %

These figures are calculated from the data in Scott's "The Diurnal Range of Rain," *Meteorological Council, Official No. 143*, London, 1900.

SEASONAL LIMITS.

By Fredk. J. Brodie.

The pleas advanced in your issue of November last in favour of a re-adjustment of the seasonal limits employed in this country for meteorological purposes have led to an interesting correspondence, and to the expression of a wide diversity of opinion.

The propositions set forth were briefly these :—

1.—That the division of the year into four periods, each consisting of three calendar months, is unsatisfactory, inasmuch as the weather normally associated with a particular season occurs not infrequently outside the assigned limits, and is, in practice, credited to a season to which it does not properly belong.

2.—That the assignment of a period of equal length to each season is incorrect, inasmuch as the duration of typical Spring and Autumn weather is normally much shorter than that of typical Summer and Winter weather.

3.—That in order to secure a more equitable arrangement it is desirable to abandon for seasonal purposes, the ordinary monthly

grouping of meteorological results, and to substitute periods of varying length, consisting, in each case, of a series of weeks. According to this scheme the Spring would comprise a period of nine weeks, commencing with the middle of March, and ending with the middle of May; the Summer a period of seventeen weeks, commencing with the middle of May and ending with the middle of September; the Autumn a period of nine weeks, running from the middle of September to the middle of November; and the Winter a period of seventeen weeks, running from the middle of November to the middle of March.

Objections to proposition 1. are urged on the ground that in this country, at all events, the weather absolutely refuses to conform to any arbitrary rules, so that whatever seasonal limits we may fix the boundaries are liable at times to be overstepped. Mr. Charles Harding cites two cases in which the hottest day of the year occurred in the fourth week of September, and points triumphantly to the fact that in neither of these instances would the warmth have been included in the proposed Summer limits. The answer to such an objection is that the suggested arrangement is designed to meet cases which are likely to occur, not cases which are altogether exceptional. Against Mr. Harding's two instances I could mention four (all within the past 35 years), in which the hottest day of the year occurred quite early in September, and would therefore have been included within the Summer limits suggested in the scheme.

The criticisms excited by proposition 2. lead to the question as to which is meant by the terms Spring and Autumn. In this connection the dictionary affords very little help, and we must, therefore, attempt to form definitions of our own. The one season may, I think, be regarded as the period during which Nature awakes more or less gradually from its long Winter sleep; the other as the period in which it sinks more or less gradually, into repose. In attempting to fix some limits to these periods we may, perhaps, take as our guide, the behaviour of the trees, using the word in quite a general sense. In the one case we see the bare branches gradually bursting into leaf and becoming clothed eventually with the full verdure of Summer. In the other case we see the gradual decay and fall of the leaf, resulting eventually in the nakedness of Winter. Most other kinds of vegetation follow suit, and in seasons of anything like a normal character each process is, I venture to think, fairly covered by the period of nine weeks, suggested in the scheme.

Among the various objections which have been advanced, some of the most substantial are based upon what may be described as purely astronomical considerations. Most of our serious workers will probably agree that in such a connection the Sun is an altogether unreliable guide. Theoretically its influence should be greatest at

the time of the Summer solstice, when the sun reaches its greatest altitude and is longest above the horizon. Theoretically also its influence should be least at the time of the Winter solstice. As a matter of fact the maximum temperature effects lag behind each solstice to the extent of about a month. In any normal season the greatest warmth does not occur anywhere near the Summer solstice, and the term Midsummer day is a misnomer. Similarly, the greatest cold seldom occurs in or around the third week in December, but usually at least three or four weeks later. According to Mr. Bonacina a spell of severe frost which arrives late in the Winter, say in February, is altogether different in character from one which occurs in the earlier part of the Season. In a sense it is, and in a sense it is not. A late frost is accompanied by longer days, and the absence of so many hours of darkness tends to make the cold more bearable. On the other hand it is disappointing to experience a long-continued frost at a time when one is beginning to look forward to a more genial temperature. Mr. Bonacina selects two severe winter months, December, 1890, and February, 1895, and maintains that in the latter case the cold was not nearly so trying as in the former. This seems to suggest that in 1895 Mr. Bonacina occupied, in a domestic sense, an irresponsible position. The unfortunate owner of frost-blocked water pipes would scarcely have had any doubt as to the relative merits of the two Arctic spells.

It is, as Mr. Bonacina remarks, quite true that, on an average, gales and fogs are more prevalent in November than in February and that May is a sunnier month than August. In this matter we must, I venture to think, regard temperature as the only safe guide; and on that score no one could seriously agree to the extinction of February as a Winter month, or to the removal of August from its legitimate position as a very real portion of the Summer Season.

With those of your correspondents, such as Mr. Charles Harding and Mr. W. F. Denning, who advocate the retention of the present tri-monthly system on the ground of convenience and long-established usage, I can only express a very real sympathy. In view of the large accumulation of Seasonal data in the possession even of one modest worker, all arranged in accordance with the orthodox plan, the reflection that the adoption of a new scheme would entail the virtual scrapping of many years' labour, is calculated to excite feelings of a very mixed character. We must, however, bear in mind that while reform is seldom easy, its difficulties afford no excuse for persisting in a course which is, on general grounds, as I venture to think in this case, altogether indefensible.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE SEASONS.

Re Messrs. Bonacina and Aldridge. Is it lawful for one who has been a farmer and who has studied the seasons (not philosophically) for upwards of 60 years, to make a few remarks?

There is a good deal in what both gentlemen say. Here in North Lancashire we seem usually to have four winter months, November to February; three spring months, March to May; two summer months, June to July; and three autumn months, August to October. In Cornwall and Devonshire, near the coast, they have two winter months, three spring, four summer, and three autumn. But looking at the matter as regards sunshine and growth, I have for many years considered that spring began on the 14th of February, at which date labourers come earlier to their work, and preparation is made for sowing in field and garden as soon as weather permits; the spring flowers come out in spite of cold weather, and the severe frosts are not felt because the days are longer. Summer begins on the 14th of May, and even as winter lingers in the lap of spring, so spring lingers in the lap of summer, and the days at the end of May are gloriously long. Autumn begins on the 14th of August, the days are rapidly shortening and the evenings closing in, and signs of the end of the real summer are not wanting. Winter begins on the 14th of November; the days are short; men then start work later, and even though now and again we may have a little skating before the 14th of November, it does not feel like winter.

W. R. NASH, F.R.Met.Soc.

The Mount, Carke-in-Cartmel, 21st April, 1915.

Mr. Ellis in his letter last month touches on a point which leads me to bring out some further important facts in support of my arrangement of the seasons, which were not definitely noticed in my two previous communications on the subject in the January and March numbers. The lag of the meteorological after the astronomical seasons to which Mr. Ellis refers is only true for one important element, namely temperature; in practically all the other important meteorological elements which show conspicuous variation between summer and winter, the maxima and minima *do* coincide with the solstitial groups as the following indicates :—

1. *Gales.*—The months of least frequency of gales in the British Isles are May, June, July, *not* June, July, and August, and the months of greatest frequency the diametrically opposite solstitial

months, November, December and January. (*See* Mr. Brodie's paper in *Quar.Jour.Roy.Met.Soc.*, Vol. 28).

2. *Fogs.*—The months of least frequency of fog in London, or the clearest months are again the summer solstitial group, May, June, July, *not* June, July, August, and the foggiest months as well as the stormiest, are the winter solstitial months of November, December, January. (*See* Mr. Brodie's paper in *Quar.Jour.Roy. Met.Soc.*, Vol. 31).

3. *Thunderstorms.*—The months of greatest frequency of violent thunderstorms in England are certainly May, June and July, rather than June, July and August. The relationship in fact, is not so much with the temperature as with the height of the sun, thunderstorms being most frequent not so much in the hottest months as in those when the amount of surface heating is greatest. (This point is emphasized by W. J. Humphreys in his paper on thunderstorm phenomena published in the Journal of the Franklin Institute for November, 1914 [U.S.A.]).

As regards the conditions requisite for their formation, summer thunderstorms have been shown by Dr. Shaw to be the inverse phenomena of winter land-fogs.

4. *Sunshine.*—Meteorologically as well as astronomically the sunniest months are May, June and July, and the dullest November, December and January, over the country as a whole.

It is thus seen that the only important element which lags a month or two behind the solstices is temperature—which again emphasizes my contention that warmth is nearly as much a characteristic of autumn as of summer, only it is a different kind of warmth, being stored warmth instead of direct warmth, as is that of summer. Conversely, cold from a different cause is as much the character of spring as of winter. Hence summer, May, June, July, is hot by direct heat, autumn, August, September, October, is hot by accumulated heat; and winter, November, December, January, is cold by direct loss of heat, and spring, February, March and April, is cold by the accumulated effect of such loss.

As for rainfall, its variations in amount are not so definitely associated with our ideas of "summer" and "winter" as the other meteorological elements, and in this country what relationship there is is complicated by the influence of double maxima and minima in the seasonal distribution. (See paper by Dr. Mill and Mr. Salter in *Quar.Jour.Roy.Met.Soc.*, Jan., 1915). Briefly it may be said that the intensity of the summer type of rainfall follows the temperature, so that June, July and August are wetter than May, June and July, but the relationship tends to be obscured by the circumstance that August is gradually coming under the influence of the high rainfall peculiar to the autumnal season with maximum in October.

L. C. W. BONACINA.

Hampstead, N.W., April 19th, 1915.

THE SEVERE THUNDERSTORM OF MAY 6th, 1915.

THE first heat thunderstorm of the season occurred in London on the evening of May 6th, a date not far removed from the average, and whilst the storm was in essential features highly typical of its class, it had one or two somewhat unusual characteristics. As observed by me in this neighbourhood the following points are noteworthy : (1.) The storm was of very long duration, raging definitely from 8 p.m. to 10.30 p.m. (2.) The rain did not commence till quite an hour after the thunder and lightning had become severe. (3.) The air remained absolutely close and stagnant throughout, the violent gust which so often springs up during a storm being in this case entirely absent. It should be noted that the electrical conditions set in at nightfall, and this is very often the case with heat storms in England. Every year I have occasion to emphasize the facility with which heat in May breeds thunder, and I will even go so far as to say that a hot day in May, with 80° in the shade, is more likely to develop *immediate* thunderstorms than one with 90° in the shade in July.

From personal experience, too, year by year, I am becoming more and more of opinion that if we take the electrical side of thunderstorms, the worst months are May and June, but that if we take the rainfall side, the most violent storms occur in July and August. That there should be a difference in this respect is, moreover, not altogether unsupported by theory, and I hope to say something on the subject in a future article. L. C. W. BONACINA.

Hampstead, N. W., May 7th, 1915.

PARADOXICAL PHENOMENA.

THE fact that on some recent occasions the receiver of my rain gauge has been nearly empty while those of my neighbours have been overflowing, figuratively speaking, has led me to re-call some instances of exceptionally contrasted meteorological conditions in narrowly circumscribed areas.

It is a far cry from the Andes to Dartmoor, from the " Capitol " at Caracas to the Rectory at Marytavy. But the impressions of experiences at the former remain in the memory at the latter. Consequently, I may, without inconsequence, allow paradoxes to pass me without being committed to writing, and *vice versa*. For how otherwise can I treat these facts :—

1.—We never have a bad thunderstorm at Marytavy Rectory, whilst Lydford (especially), Princetown and Tavistock are reported in the local newspapers as having been visited by violent and (sometimes) destructive thunderstorms, we merely are treated to distant rumblings.

2.—About six weeks ago the lower portion of my glebe was flooded ; there was quite a lake say 100 yards long by 50 wide.

I was standing at a transit telescope not far from my rain gauge. A few drops of rain on my face made me turn round—a strange sight I saw. One portion of my lake was undisturbed; but on a patch about 50 or 60 square feet it was raining like "cats and dogs"—not a meteorological expression perhaps—but notifying a fact and emphasizing my previously named experiences.

In the summer of 1875 I was at Caracas in Venezuela, which is situated about 4000 ft. *above the sea*, and about 4000 ft. below the Silla de Caracas, a spur of the Andes. A national fête was in progress on the day which I am about to mention, but I forget the exact date and month. The local government had decorated the city in every possible way. The Plaça had wreaths of flowers and ropes of tiny lamps for evening illumination.

The square in which the Capitol is placed was also decorated "en fête." I forget the exact dimensions of the square (a rectangle at any rate), but it was about 200 yards long and about 80 or 90 yards wide.

On the top of the four façades of buildings the Government had placed flag posts (I should say each about 10 feet high), on which was one of the National flags (about 6 feet by 3 feet), and the flag posts looked about 15 feet apart. The day was bright and calm, just occasionally the slightest puff of wind to show to advantage this rectangle of flags, dozens and dozens of them. I could see, over the top of an intervening building, every flag in the, so-called, square. During the afternoon I happened to be using my binoculars, looking at the Silla, on the Sierra, when a breeze sprang up and—I wondered if I was mad, bilious, or if I had developed some disease of the eye—for, as I looked from my window, I could see the flags of the two ends of the rectangle were blowing in different directions.

IRVINE KEMPT ANDERSON.

Marytavy Rectory, Tavistock, 20th March, 1915.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of the above Society was held on April 21st at the Surveyors' Institution, Westminster, Major H. G. Lyons, F.R.S., President, in the Chair.

A paper on "A Study of the Moving Waves of Weather in South America," by Mr. H. Helm Clayton, M.A., was read by Mr. R. C. Mossman. The author noted that the charts showing the weather conditions over the South American continent indicated permanent centres of high pressure at about 30° S. latitude. These high pressure systems oscillate slowly back and forth over limited areas, and there is a series of low pressure systems passing from west to east immediately south of the continent, *viz.*, in about 60° S. lat. An examination of the charts of daily pressure and temperature

changes seems to show that these changes are in the nature of waves, which, appearing first in the extreme south of South America, progress northward or north-eastward, and, diminishing in intensity, die out or disappear near the equator. It is clearly evident that these waves of changing pressure do not follow the movements of centres of high and low pressure, but that they are independent phenomena causing changes in the distribution of pressure and in the shapes of the isobars, and in this way giving rise to changes of wind and weather. In order to raise forecasting from an art to a science, Mr. Clayton believes it is essential to replace mental estimates by quantitative measurements of expected changes and to make quantitative forecasts. He applied this principle to the Argentine weather map for April 20th, 1910, and showed the map of pressure predicted in this way for April 21st together with the map of observed pressures. There was a marked similarity in the trend of the isobars in the two maps. The daily temperatures at 8 a.m. were plotted for four stations for May and June, 1910, which revealed two classes of waves taking about 3 and 6 days respectively to pass from Punta Arenas to Rio de Janeiro.

The President, Mr. Tripp, Mr. Lempfert and Mr. Mossman spoke.

A paper on "The Correlation between changes in Barometric Height at Stations in the British Isles," by Mr. E. H. Chapman, M.A., was also read. The records at Cronkbourne, Isle of Man, were examined in conjunction with those at eleven other stations radiating out from it in all directions, in order to ascertain the relationships existing between changes in the barometric height at Cronkbourne from 9 a.m. to 9 p.m., and changes in the barometric height at the other stations, (i.) between 9 a.m. and 9 p.m. the day before, (ii.) between 9 p.m. the night before and 9 a.m. the same day, (iii.) between 9 p.m. the same day and 9 a.m. the day after, and (iv.) between 9 a.m. and 9 p.m. the day after. The records dealt with extended over the ten years 1895 to 1904, and the year was first treated as a whole, and afterwards the relationships existing in the individual months were considered. The author concluded that the magnitude of the correlation obtained depends upon the time limit, and was not satisfied that the twelve-hour unit, which he had to use, is the best. Assuming, however, that the time limit must be 12 hours, the best information for fortelling barometric changes is from a station 300 or 400 miles in a south-westerly direction from the place for which inferences are required.

Mr. F. J. Whipple, Mr. R. H. Hooker, Mr. W. W. Bryant, Dr. C. Chree and Dr. E. C. Snow took part in the discussion.

The following gentlemen were elected Fellows of the Society :—Mr. David Balfour, C.E., Mr. Peshoton S. G. Dubash, Mr. Geo. Philip, Mr. E. R. Roe-Thompson and Lieut. C. R. Treweek, R.N.R. At the March meeting the following were elected :—Mr. Harold Billett, Mr. E. Newnham, Mr. D. S. Salter and Mr. R. R. N. Sen.

INTERNATIONAL BALLOON ASCENTS.

By W. H. DINES, F.R.S.

February 1st, 1912.

Starting Point.	Country.	A (Hc) miles	B (Tc) ° F.	C miles.	D ° F.	E miles.	F
Manchester	England ..	7·2	—76	10·4	—63	145	S.E.
*Pyrton Hill	„ ..	6·0	—72	8·5	—72	60	S. by E.
Brussels	Belgium ..	6·3	—85	8·8	?	98	S.E.
Lindenberg	Germany..	5·1	—60	9·8	—62	89	E.S.E.
Paris.....	France....	7·4	—92	9·0	—77	187	S.E. by E.
Strassburg	Germany..	6·6	—84	7·6	—76	89	S.E. by E.
Vienna.....	Austria ..	5·9	—72	7·8	—67	46	E. by S.
Nizhni Olchedaeff	Russia	6·1	—76	10·4	—63	82	E.N.E.

* Evening of January 30th.

On January 31st a low pressure area lay over Stockholm, on February 1st pressure was decreasing over the North Sea and the depression was extending westwards; on February 2nd the barometer had fallen over the Bay of Biscay and a trough of low pressure extended from the Bay of Biscay to the Gulf of Bothnia.

The values of Tc are very irregular, the difference of 32° F. between Paris and Lindenberg being unusually large, but as is generally the rule in such cases, much greater uniformity is shown at 9 or 10 miles' height.

March 7th, 1912.

Starting Point.	Country.	A (H_c) miles.	B (T_c) ° F.	C miles.	D ° F.	E miles	F
Manchester.....	England ..	5·3	—71	12·2	—63	56	E. by S.
Brussels	Belgium ..	4·7	—83	11·3	?	39	E.
Lindenberg.....	Germany..	5·0	—71	8·6	—65	45	E.N.E.
Paris	France....	5·4	—74	9·7	—66	55	E.S.E.
Strassburg	Germany..	5·2	—66	7·8	—54	39	N.N.E.
Vienna.....	Austria....	4·8	—61	7·1	?	54	N.N.E.
Pavlowsk.....	Russia	6·2	—72	10·6	—67	44	E.N.E.
Batavia	E. Indies over	9·3	?	9·3	—107	22	E. by S.

The central parts of Europe were covered by an extensive depression with high pressure both north and south.

The values of Hc are low in accordance with usual rule. The return from Batavia appears for the first time in the international publication. The extremely low temperature of —107° F. is quite usual for a height of 9 miles at a tropical station.

A Height in miles of commencement of isothermal column.
B Temperature, F°., at bottom of column.
C Greatest height of reliable record in miles.
D Temperature, F°., at greatest height.
E Distance in miles of point where balloon fell
F Bearing of falling point from starting point

METEOROLOGICAL NEWS AND NOTES.

THE METEOROLOGICAL OFFICE has intimated that "From May 1st, 1915, the issue to the public of Form 216, giving weather forecasts for the several districts of the British Isles, will be suspended. Arrangements have been approved for the supply of forecasts by telegraph for agricultural purposes upon payment of the cost of the telegrams as in previous years. The issue of Form 202, giving meteorological statistics for health resorts, will be continued to those subscribers to the Daily Weather Report who have expressed a wish to receive it."

MR. J. E. CULLUM has retired from his position as Superintendent of the Valencia Meteorological Observatory, Cahirciveen, and the Meteorological Office has appointed Mr. L. H. G. Dines as his successor.

NEWS FROM THE SOUTH ORKNEYS was brought by the Argentine gunboat "Uruguay," which returned to Buenos Aires on March 11th, after landing a new party and relieving the Observers who had spent 1914 on Laurie Island. Exceptionally fine weather prevailed throughout the six weeks covered by the double journey, which the Commander described as a "pleasure trip." Reference to the meteorological records brought back from Laurie Island showed that the remarkable absence of gales in the usually stormy area south of lat. 40° S., had persisted since September. October, November, and December had each the lowest mean wind velocity hitherto observed for these months. At the close of the year there was still much ice round the South Orkney group, the absence of ocean swell and the light winds having retarded the break up of the floes. As the station is only visited annually by a relief ship, the Observers had remained in blissful ignorance of the war, until well on in February.

"NO WILL, NO WAY," was the terse comment of a valued correspondent in sending us the newspaper report of a discussion in the Folkestone Town Council on April 28th, when a motion to suspend the weather reports was moved, seconded, and carried, on the ground that the Corporation had no longer the means to provide an annual grant of £50 for the purpose. We are glad to observe that several members of the Council were sufficiently enlightened and courageous to oppose the motion, but that has not prevented the discontinuance of observations and the breaking of a record which can never be pieced together again. The quaint plea was brought forward by one ingenuous Councillor that "that was one of the things that was a sort of luxury, and could very well be dispensed with!"

MR. LOUIS G. SCHULTZ, Director of the Argentine Central Magnetic Observatory at Pilar, since its foundation in 1903, has recently resigned and returned to the United States.

RAINFALL TABLE FOR APRIL, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	1·74	1·13
Tenterden	*Kent*	51 4	*0 41	190	1·77	1·37
Arundel (Patching)	*Sussex*	50 51	0 27	130	1·82	1·68
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	1·98	1·21
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	1·67	·78
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	1·78	·66
Shoeburyness	*Essex*	51 31	*0 48	13	1·25	·92
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	1·62	·92
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	1·55	·95
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	2·34	1·39
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·39	·87
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·09	1·32
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·20	1·78
Boston	*Lincolnshire*	52 58	0 1	11	1·57	·48
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	1·62	·76
Mickleover Manor	*Derbyshire*	52 54	1 32	280	1·77	·75
Macclesfield	*Cheshire*	53 15	2 7	501	2·02	1·63
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	1·84	2·28
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	3·73	3·45
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	1·85	1·19
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	1·69	·60
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	1·84	·56
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	6·91	9·79
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	2·50	1·79
Haverfordwest	*Pembroke*	51 48	4 58	90	2·82	1·97
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	2·48	2·89
Llandudno	*Carnarvon*	53 20	3 50	72	1·79	2·31
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	2·50	3·40
Marchmont House	*Berwick*	55 44	2 24	498	2·28	·56
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	2·81	3·79
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	1·86	2·37
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	3·69	6·48
Mull (Quinish)	,,	56 34	6 13	35	2·98	4·71
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	1·93	·84
Braemar	*Aberdeen*	57 0	3 24	1114	2·30	2·14
Aberdeen (Cranford)	,,	57 8	2 7	120	2·23	1·20
Gordon Castle	*Moray*	57 37	3 5	107	1·74	2·24
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	2·22	4·52
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	4·70	8·01
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·02	3·09
Wick	*Caithness*	58 26	3 6	77	1·89	2·13
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	3·46	2·95
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	2·68	1·68
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	2·54	2·22
Ennistymon House	*Clare*	52 57	9 18	37	2·81	2·86
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·37	·86
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·54	1·71
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·03	1·42
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	2·37	2·40
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	3·13	3·76
Cong (The Glebe)	,,	53 33	9 16	112	2·98	3·19
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	2·52	3·73
Seaforde	*Down*	54 19	5 50	180	2·76	2·36
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	2·08	2·66
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	2·50	2·99

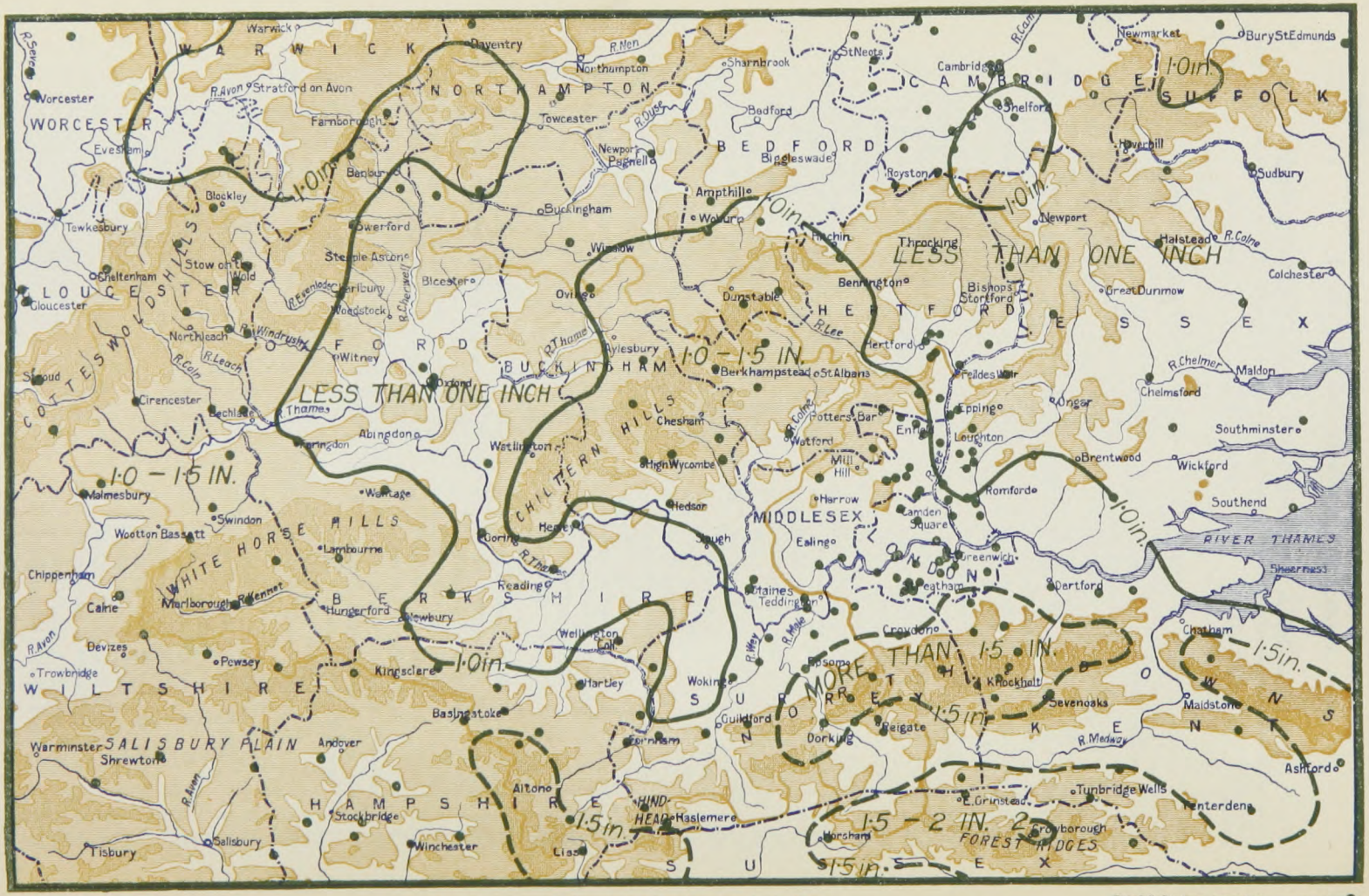
RAINFALL TABLE FOR APRIL, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875–1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875–1909. in.	STATION.
— ·61	65	·26	12	9	6·93	9·53	+2·60	138	25·11	Camden Square
— ·40	77	·54	6	12	7·76	9·81	+2·05	126	27·64	Tenterden
— ·14	92	·54	6	12	8·53	12·14	+3·61	142	30·48	Patching
— ·77	61	·47	6	12	9·18	11·79	+2·61	128	31·87	Cadland
— ·89	47	·32	12	10	6·52	7·90	+1·38	121	24·58	Oxford
—1·12	37	·19	12	9	7·10	6·62	— ·48	93	25·20	Swanspool
— ·33	74	·24	12	15	4·96	5·37	+ ·41	108	19·28	Shoeburyness
— ·70	57	·35	12	8	6·62	8·06	+1·44	122	25·40	Westley
— ·60	61	·33	12	12	6·06	9·00	+2·94	148	23·73	Geldeston
— ·95	59	·27	9	15	11·62	15·91	+4·29	137	38·27	Polapit Tamar
—1·52	36	·33	6	14	10·13	10·85	+ ·72	107	33·54	Rousdon
— ·77	63	·30	12	13	8·55	10·16	+1·61	119	29·81	Stroud
— ·42	81	·30	2	14	9·07	12·61	+3·54	139	32·41	Wolstaston
—1·09	31	·13	12	12	6·11	6·43	+ ·32	105	23·35	Boston
— ·86	47	·20	12	11	6·66	6·57	— ·09	99	24·46	Hodsock Priory
—1·02	42	·18	12	11	7·12	6·90	— ·22	97	26·65	Mickleover
— ·39	81	·26	3	17	9·48	12·58	+3·10	133	34·73	Macclesfield
+ ·44	124	·49	3	16	8·57	11·07	+2·50	129	32·70	Southport
— ·28	92	·69	19	17	20·04	24·72	+4·68	123	61·49	Arncliffe
— ·66	64	·35	2	6	7·37	9·19	+1·82	125	26·87	Ribston Hall
—1·09	36	·20	12	8	7·01	8·23	+1·22	117	26·42	Hull
—1·28	30	·14	12	15	7·47	7·59	+ ·12	102	27·94	Newcastle
+2·88	142	3·67	20	17	41·94	52·26	+10·32	125	129·48	Seathwaite
— ·71	72	·47	3	19	12·11	12·81	+ ·70	106	42·28	Cardiff
— ·85	70	·33	2, 30	13	14·09	15·99	+1·90	113	46·81	Haverfordwest
+ ·41	116	·71	2	16	12·52	17·84	+5·32	142	45·46	Gogerddan
+ ·52	129	·35	10	17	8·54	10·08	+1·54	118	30·36	Llandudno
+ ·90	136	·60	19	19	13·35	19·93	+6·58	149	43·47	Cargen
—1·72	25	·10	21	9	9·47	7·91	—1·56	84	33·76	Marchmont
+ ·98	135	·60	3	21	15·08	21·27	+6·19	141	49·77	Girvan
+ ·51	127	·30	7	21	10·70	10·20	— ·50	95	35·97	Glasgow
+2·79	175	·93	18	24	22·15	28·56	+6·41	129	68·67	Inveraray
+1·73	158	·63	19	22	17·26	22·65	+5·39	131	56·57	Quinish
—1·09	44	·14	4	14	7·91	8·69	+ ·78	110	28·64	Dundee
— ·16	93	·48	8	20	10·64	15·33	+4·69	144	34·93	Braemar
—1·03	54	·29	30	11	9·60	10·93	+1·33	114	32·73	Aberdeen
+ ·50	129	·58	19	19	8·04	11·11	+3·07	138	30·34	Gordon Castle
+2·30	204	1·00	18	21	15·79	13·77	—2·02	87	44·53	Fort Augustus
+3·31	170	1·41	18	21	28·94	33·22	+4·28	115	83·93	Bendamph
+1·07	153	·53	30	18	9·99	...	...	...	31·90	Dunrobin Castle
+ ·24	113	...	...	...	8·84	8·80	— ·04	99	29·88	Wick
— ·51	85	·65	9	18	18·90	19·43	+ ·53	103	54·81	Killarney
—1·00	63	·42	5	12	12·28	10·73	—1·55	87	39·57	Waterford
— ·32	87	·48	5	15	12·30	13·34	+1·04	108	39·43	Castle Lough
+ ·05	102	·48	9	20	13·79	17·24	+3·45	125	46·52	Enniskymon
—1·51	36	·21	5	11	10·59	9·44	—1·15	89	34·99	Courtown Ho.
— ·83	67	·26	30	19	10·83	11·08	+ ·25	102	35·92	Abbey Leix
— ·61	70	·21	30	19	8·08	7·90	— ·18	98	27·68	Dublin
+ ·03	101	·52	30	22	10·78	13·68	+2·90	127	36·15	Mullingar.
+ ·63	120	·54	19	20	17·04	18·80	+1·76	110	52·87	Enniscoe
+ ·21	107	·57	30	18	15·29	16·74	+1·45	109	48·90	Cong
+1·21	148	·49	9	20	12·92	16·41	+3·49	127	42·71	Markree
— ·40	85	·42	2, 30	17	11·82	12·16	+ ·34	103	38·91	Seaforde
+ ·58	128	·37	10	20	10·56	9·81	— ·75	93	37·56	Dundarave
+ ·49	120	·45	7	20	11·62	13·33	+1·71	115	39·38	Omagh

SUPPLEMENTARY RAINFALL, APRIL, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road	1·83	XI.	Lligwy	1·82
,,	Ramsgate	1·28	,,	Douglas	2·66
,,	Hailsham	1·77	XII.	Stoneykirk, Ardwell House	2·80
,,	Totland Bay, Aston House	1·21	,,	Carsphairn Shiel	4·73
,,	Stockbridge, Ashley	1·22	,,	Beattock, Kinnelhead	3·69
,,	Grayshott	1·42	,,	Langholm, Drove Road	3·06
III.	Harrow Weald, Hill House	1·11	XIII.	Meggat Water, Cramilt Lodge	1·39
,,	Caversham, Rectory Road	·85	,,	North Berwick Reservoir	·79
,,	Pitsford, Sedgebrook	·68	,,	Edinburgh, Royal Observaty.	1·28
,,	Woburn, Milton Bryant	1·01	XIV.	Maybole, Knockdon Farm	2·27
,,	Chatteris, The Priory	·45	XV.	Ballachulish House	8·18
IV.	Elsenham, Gaunts End	·85	,,	Campbeltown, Witchburn	2·66
,,	Colchester, Hill Ho., Lexden	·71	,,	Holy Loch, Ardnadam	5·77
,,	Ipswich, Rookwood, Copdock	1·16	,,	Islay, Eallabus	4·67
,,	Blakeney	·64	,,	Tiree, Cornaigmore	3·54
,,	Swaffham	·85	XVI.	Dollar Academy	2·16
V.	Bishops Cannings	1·41	,,	Balquhidder, Stronvar	...
,,	Wimborne, St. John's Hill	1·53	,,	Glenlyon, Meggernie Castle	5·22
,,	Ashburton, Druid House	1·58	,,	Blair Atholl	2·31
,,	Cullompton	1·25	,,	Coupar Angus	1·04
,,	Lynmouth, Rock House	1·55	,,	Montrose, Sunnyside Asylum.	·62
,,	Okehampton, Oaklands	1·97	XVII.	Alford, Lynturk Manse	1·18
,,	Hartland Abbey	1·36	,,	Fyvie Castle	1·65
,,	Probus, Lamellyn	1·50	,,	Keith Station	2·00
,,	North Cadbury Rectory	1·32	XVIII.	Rothiemurchus	3·80
VI.	Clifton, Pembroke Road	1·42	,,	Loch Quoich, Loan	17·90
,,	Ross, The Graig	·74	,,	Drumnadrochit	3·37
,,	Shifnal, Hatton Grange	1·30	,,	Skye, Dunvegan	5·77
,,	Droitwich	1·43	,,	Lochmaddy, Bayhead	4·67
,,	Blockley, Upton Wold	1·34	,,	Glencarron Lodge	9·17
VII.	Market Overton	·96	XIX.	Invershin	3·72
,,	Market Rasen	·71	,,	Melvich	...
,,	Bawtry, Hesley Hall	·69	,,	Loch Stack, Achfary	8·79
,,	Derby, Midland Railway	·96	XX.	Dunmanway, The Rectory	2·68
,,	Buxton	2·12	,,	Glanmire, Lota Lodge	1·40
VIII.	Nantwich, Dorfold Hall	1·18	,,	Mitchelstown Castle	1·48
,,	Chatburn, Middlewood	2·11	,,	Darrynane Abbey	2·31
,,	Lancaster, Strathspey	2·60	,,	Clonmel, Bruce Villa	1·48
IX.	Langsett Moor, Up. Midhope	1·59	,,	Newmarket-on-Fergus, Fenloe	2·11
,,	Scarborough, Scalby	1·28	XXI.	Laragh, Glendalough	1·74
,,	Ingleby Greenhow	1·11	,,	Ballycumber, Moorock Lodge	2·03
,,	Mickleton	2·10	,,	Balbriggan, Ardgillan	1·78
X.	Bellingham, High Green Manor	1·55	XXII.	Ballynahinch Castle	4·66
,,	Ilderton, Lilburn Cottage	·59	,,	Woodlawn	2·65
,,	Keswick, The Bank	3·44	,,	Westport, St. Helens	3·17
XI.	Llanfrechfa Grange	1·36	,,	Dugort, Slievemore Hotel	4·56
,,	Treherbert, Tyn-y-waun	3·75	,,	Mohill Rectory	2·30
,,	Carmarthen, The Friary	2·08	XXIII.	Enniskillen, Portora	2·45
,,	Fishguard Goodwick Station.	2·00	,,	Dartrey [Cootehill]	2·41
,,	Crickhowell, Tal-y-maes	1·80	,,	Warrenpoint, Manor House	2·37
,,	New Radnor, Ednol	...	,,	Banbridge, Milltown	2·46
,,	Birmingham WW., Tyrmynydd	2·21	,,	Belfast, Cave Hill Road	2·32
,,	Lake Vyrnwy	1·69	,,	Ballymena Harryville	3·37
,,	Llangynhafal, Plâs Draw	1·65	,,	Londonderry, Creggan Res.	3·84
,,	Dolgelly, Bryntirion	4·47	,,	Dunfanaghy, Horn Head	3·84
,,	Bettws-y-Coed, Tyn-y-bryn	...	,,	Killybegs	6·12

THAMES VALLEY RAINFALL. —— APRIL, 1915.



THE WEATHER OF APRIL.

The cold weather of the closing days of March was succeeded by a gradual increase of temperature during the first week of April, but the weather remained unsettled generally. A depression skirting the north-western coasts caused rain in most districts on the 2nd, and the fall exceeded an inch in the north of Ireland, the Lake District and the west of Scotland. The changeable conditions continued over Ireland and the north and west of Great Britain, but in the south and east it was more settled after the 3rd and relatively sunny. Thunderstorms were rather widespread over England on the 7th, and occurred in London and Manchester on the 8th. On the latter day a deep depression passed across the north of Scotland to the eastward, and occasioned heavy rain in the northern districts, the fall amounting to 1·85 in. at Glencarron. Anticyclonic conditions prevailed generally from the 11th to the 17th, and, except in the north of Ireland and the west of Scotland, the weather was dry. There was, however, a deficiency of bright sunshine except in the extreme south of England. Heavy rain accompanied a depression which crossed Scotland to the North Sea on the 18th and 19th, amounting to considerably more than an inch on both days at many widely distributed stations in the north and west, and reaching 2·10 in. at Furnace (Argyll) and rather more than 3·00 in. in the Lake District on the 19th. In the south and east of England the weather was fine and sunny. Temperature was low for the time of year, and night frosts occurred in all parts of Great Britain between the 18th and 21st. During the last ten days of the month the pressure distribution underwent but little change, remaining generally anticyclonic, and fair or fine dry weather prevailed with an increase of warmth in the last week. Shade maxima of 70° or above occurred in most districts between the 28th and 30th, and 73° was recorded at Fort William on the 28th, and at Bawtry and Raunds on the 30th.

The month was again very dry over England, the total rainfall being less than an inch over practically the whole of the east of England and the Midlands as far west as Derby. Part of this area is shown on the accompanying map, extending over the Thames Valley around Oxford and as far south as Aldershot. The fall exceeded 2·00 in. only over the Pennines and the country to the west, over Wales, Exmoor, Dartmoor, and a small area in north-east Sussex. In Scotland the fall was generally heavy, and was only less than 2·00 in. in the east and south-east and along the shores of the Moray Firth. A large area with more than 6·00 in. extended over the western Highlands. In Ireland the fall was heavy in the north and west but light in the south and east. Over Munster and Leinster it was less than 2·00 in., except in the west. The greater part of Ulster had more than 3·00 in., and in the Connemara district some stations had more than 7 in. Over the Kingdom, as a whole, the general rainfall expressed as a percentage of the average was as follows: England and Wales, 78; Scotland, 129; Ireland, 95: British Isles, 96.

The following amounts of the duration of sunshine are reported: London (Camden Square) 151·2 hours, Margate 190·6 hours, Totland Bay 179·7 hours, Copdock 176·3 hours, Weymouth 158·4 hours, Ilfracombe 157·9 hours, Ashbourne 160·5 hours, Matlock Bath 150·6 hours, Southport 184·6 hours, Hull 124·4 hours, Haverfordwest 170·5 hours, Paisley Observatory 146·0 hours, Perth 180·6 hours, and Loch Stack 107·0 hours.

In London the month was fine and dry generally, especially in the latter half when the duration of sunshine frequently exceeded 10 hours per day. The mean temperature, 48°·1 was exactly equal to the average. Duration of rainfall, 31·8 hours. Evaporation, 1·65 in.

Climatological Table for the British Empire, November, 1914.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	61·3	5	29·7	18	51·0	39·9	41·6	89	88·0	26·1	3·52	18	7·2
Malta	75·2	1	50·9	29	68·0	57·9	...	79	131·0	...	3·49	14	1·6
Lagos	91·0	23	72·0	11†	87·5	76·2	74·0	75	156·2	69·0	7·01	9	6·5
Cape Town	89·9	25	46·8	17	73·1	56·7	52·9	66	...	...	1·09	6	4·0
Natal, Durban ...	..	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	89·6	17	40·9	11	72·7	51·3	49·7	71	...	40·1	6·86	19	3 6
Mauritius	84·4	13*	66·2	5	82·4	68·5	62·8	67	...	58·3	·93	16	5·3
Bloemfontein	92·1	16	39·5	11	78·4	53·0	46·1	50	...	...	3·46	9	3·6
Calcutta...	89·4	4, 5	58·6	26	84·6	63·8	61·2	66	...	53·8	·00	0	1·5
Bombay...	93·2	11	71·7	25	90·0	76·3	69·8	66	139·0	59·3	·18	2	2·6
Madras	87·3	9	65·2	23	85·1	73·0	71·8	82	155·6	61·3	14·03	12	5·4
Colombo, Ceylon ...	89·7	13	69·0	24	87·3	73·4	72·9	80	162·0	62·8	11·97	17	7·1
Hongkong	81·8	3	59·0	29	73·5	66·4	61·7	74	...	...	8·82	16	7·8
Sydney	91·1	21	59·2	30	77·8	65·2	60·8	69	152·9	52·0	2·57	18	7·5
Melbourne	93·7	16	44·7	22	74·9	55·5	50·4	57	156·7	36·8	2·37	14	5·7
Adelaide	100·3	13	50·6	27	83·7	60·4	52·8	48	159·7	44·8	2·05	8	5·6
Perth	89·8	29	46·9	24	75·7	58·2	54·6	64	159·0	41·0	1·73	12	5·0
Coolgardie	94·6	20	45·4	24	79·9	58·3	52·5	55	163·8	43·4	3·06	12	5·8
Hobart, Tasmania ..	86·3	14	38·0	28	65·8	48·3	43·2	59	152·0	32·2	1·66	12	6·1
Wellington ...	68·8	19	41·8	20	61·3	51·1	48·2	75	138·8	29·0	1·98	11	7·5
Auckland	71·5	25	47·5	6	64·6	52·2	50·9	76	142·0	45·0	1·45	16	6·8
Jamaica, Kingston .	92·0	1	69·8	28	88·2	72·2	71·7	84	...	...	1·56	8	5·0
Grenada	87·0	13	72·0	4‡	83·9	75·0	...	79	136·0	...	7·77	20	3·8
Toronto	62·0	3	12·8	23	45·4	30·8	30·8	80	105·0	10·5	2·83	12	5·7
Fredericton	58·0	16	3·0	19	39·6	22·2	...	84	...	...	2·71	9	6·1
St. John, N.B. ...	56·6	2	9·8	19	42·7	27·7	29·0	78	...	...	3·72	13	6·2
Alberta, Edmonton ...	54·0	2	—4·8	16	36·5	22·1	...	78	103·0	—11·0	·76	10	6·5
Victoria, B.C.	54·2	1	33·2	13	48·4	41·5	...	92	...	...	5·83	25	8·1

* and 24. † and 18. ‡ and 17, 19.

Johannesburg.—Bright sunshine 254·3 hours. Rainfall a record for November for 11 years since observations commenced.

Mauritius.—Mean temp. 0°·2, dew point 1°·4, and R ·81 in., below averages. Mean hourly velocity of wind 13·4 miles, or 2·7 miles above average.

COLOMBO, CEYLON.—Mean temp. 80°·4 or 0°·7 above, dew point 0°·2 below, and R 1·82 in. above, averages. Mean hourly velocity of wind 5·0 miles.

HONGKONG.—Mean temp. 69°·9. Mean hourly velocity of wind 11·3 miles. Bright sunshine 113·1 hours.

Melbourne.—Mean temp. 4°·0 above, and R ·18 in. above, averages.

Adelaide.—Mean temp. 5°·0 above, and R ·90 in. above, averages.

Perth.—Temp. 1°·6 above, and R generally above, averages.

Coolgardie.—Temp. 0°·9 below, and R 2·5 in. above, averages.

Hobart.—Temp. 0°·3 below, and R ·86 in. below, averages.

Wellington.—Mean temp. 0°·6 below, and R 1·40 in. below, averages. Bright sunshine 200·3 hours.

Auckland.—Mean temp. 2°·5 below, and R under half the averages.

ALBERTA, EDMONTON.—Warm, dry and cloudy, with great temperature variations, frequent snow showers.

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SOUTHERN HEMISPHERE WEATHER IN 1914.

By R. C. Mossman, F.R.S.E.

The year 1914 presented many abnormal meteorological features in the Southern Hemisphere. We have taken as a basis for discussion the monthly values of mean temperature, rainfall, and in some cases barometric pressure, given in the *Climatological Table of the British Empire*, which appears monthly in this Magazine. These data have been supplemented by other material, supplied through the kindness of the Directors of the Meteorological Services of Great Britain, Argentina, Brazil, and Chile stations with incomplete data, except in one instance, have not been used.

I am also indebted to the Superintendent of the Observatory of Johannesburg and to Dr. Sutton of Kimberley, as well as to the Secretary of the Scottish Meteorological Society, for further data. Some additional information has also been derived from Monthly Bulletins in the library of the Royal Meteorological Society. As the result of this co-operation we are able to give monthly rainfall data for 24 stations, temperature for 21 stations, and barometric pressure for 8 stations. The somewhat scanty material from Argentina has been strengthened by values obtained from the Monthly Weather Maps of that country. Among the less known stations quoted Evangelists Island is at the Pacific entrance to the Straits of Magellan, in 52½° S. lat., Point Galera, Valdivia, and Concepcion are on the coast of Chile, between latitudes 40° and 37° S., and Christmas Island lies in the Indian Ocean, in lat 10½° S., long. 106° E. Ajo is close to the littoral in the province of Buenos Aires, in lat. 36½° S., long. 57° W., while South Georgia and the South Orkneys are in the far South Atlantic, the former being in 54° S., 36½° W., and the latter in 61° S., and 45° W. Two stations in the West Indies have been included in the rain table, as the data from this region are of interest in relation to the conditions in Argentina. All the other stations are south of the Tropic of Capricorn, except Rio de Janeiro, St. Helena, and Christmas Island. The averages where available, refer to long terms of years, but in most cases a slightly shorter period than that covered by the whole series of observations has been taken. The New Zealand and Cape Town data

refer to the 40 years 1871-1910, and in the case of the Chilean rain data, the monthly and annual means have been referred to a short average, for the years 1901 to 1910, as well as to longer normals where these were available. As the rainfall in Chile is subject to wide variations from year to year, it was necessary in order that the discussion should proceed on a uniform basis, to use a normal for the same term of years. It may be pointed out that the average temperature is in nearly every case, the mean of the daily maximum and minimum, the exceptions being Rio de Janeiro, Santiago de Chile, the South Orkneys and South Georgia, where the data

TABLE I.—*Barometric Pressure in 1914. Departure from Normal. Hundredths of an inch.*

NOTE.—Record Values are shown in heavy type.

	Jan	Feb.	Mar.	April.	May.	June.
Perth	+ 5	+ 5	— 2	+ 4	+ 9	+12
Melbourne	+ 2	+ 5	— 2	— 1	+ 7	+20
Wellington	+ 7	— 4	+ 6	—15	+ 4	— 1
S. Orkneys	+ 5	— 2	+ 6	— 1	—15	—11
Punta Arenas	+ 5	+ 1	+15	+12	— 3	—17
Santiago	— 1	0	— 1	— 1	0	— 2
Rio de Janeiro	+ 2	+ 6	+ 4	+ 5	+ 8	— 2
Johannesburg	+ 2	+ 3	+ 2	0	+ 4	0

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
Perth	+ 2	+ 9	+13	+ 1	— 2	— 6	+ 4
Melbourne	+ 4	+23	+25	+27	+10	(—6)	(+10)
Wellington	+ 8	+ 8	+22	+19	— 1	— 5	+ 4
S. Orkneys	+11	— 2	+ 8	—31	— 8	— 3	— 4
Punta Arenas	+ 1	+ 3	+ 1	+11	— 4	+17	+ 3
Santiago	— 2	— 3	— 2	— 2	— 5	0	— 2
Rio de Janeiro	— 6	— 1	—11	+ 2	— 3	— 5	0
Johannesburg	+ 2	+ 1	+ 2	+ 4	+ 2	+ 1	+ 2

are either derived from hourly observations or corrected to the true mean of the day. Not having temperature data from Argentina, the mean temperature from seven stations north of lat. 40° S., and for four stations south of this latitude, was measured off the monthly isothermal charts issued by the *Oficina Meteorológica*, and the values referred to normals for the respective stations, given in the *Climate of the Argentine Republic* by W. G. Davis, Buenos Aires, 1910. The normals there given refer to the ten years 1898-1907. In the four tables appended are given the departure of the mean monthly and annual barometric pressure from the normal (Table I.); the departure of mean temperature from the normal (Table II.); the actual rainfall (Table III.); and the

TABLE II.—*Monthly and Annual Departure of the Mean Temperature during* **1914** *from the Normal 0°F.*

NOTE.—Record Values are shown in heavy type.

	Years of Obsns.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
AUSTRALIA.	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Perth	17	+1·6	—2·4	+1·0	**—4·5**	—1·9	+0·6	—0·8	+2·1	**+3·0**	**+5·0**	—1·6	—1·1	+0·4
Adelaide	58	—2·6	+2·9	+2·9	+0·3	+1·3	+1·4	+0·9	**+4·5**	+0·8	**+7·7**	+4·9	+1·9	**+2·2**
Melbourne	59	—0·5	+3·7	+3·1	+0·5	+0·7	+1·2	—0·4	+1·4	—0·8	**+4·3**	**+3·9**	+1·7	+1·6
Sydney	56	+1·4	+1·1	+1·5	**+3·6**	+1·9	+1·5	+0·5	**+2·5**	+0·9	+1·9	**+4·5**	+2·7	**+2·0**
TASMANIA.														
Hobart	44	—0·6	+0·4	+1·7	—0·6	+1·2	+1·8	—0·1	+2·5	+0·5	+2·9	—0·5	—2·3	+0·6
NEW ZEALAND.														
Auckland	47	+1·0	—0·6	—0·3	—0·4	—2·8	—2·3	—1·6	—1·5	—1·2	—1;4	—1·9	—3·4	—1·4
Wellington	47	+2·7	+1·1	+0·4	+1·0	—2·4	—0·9	+0·5	+0·2	+1·0	+1·5	—0·6	—2·9	+0·1
Hokitika	30	—1·7	—1·2	0·0	—1·2	—3·3	—3·3	+0·9	—1·3	—1·9	—2·4	**—3·5**	**—7·4**	—2·2
Dunedin	47	+2·9	+0·3	+1·7	+0·8	—1·7	+0·7	+2·0	+2·2	+2·2	+2·0	—1·2	—3·9	+0·7
SUB-ANTARCTIC.														
South Orkneys	12	—0·4	+0·4	+1·6	**+5·0**	+6·5	+1·4	—3·4	+3·1	+0·2	—3·2	—1·5	+1·4	+0·9
South Georgia	10	—1·1	+0·7	+0·5	**+2·1**	+2·5	+1·5	—0·9	—1·1	—0·9	—	—	—	—
S. AMERICA.														
Punta Arenas	27	—1·9	—1·4	+1·2	—0·7	—1·0	—2·9	—3·7	—0·4	—2·0	+0·1	—3·6	—0·1	—1·4
Santiago de Chile	54	**+3·8**	+3·0	+0·3	—0·9	+0·5	+1·2	+3·9	+1·8	—0·9	—0·4	—2·1	—0·7	+0·8
Argentina S. (4 stations)	10	—1·1	+2·7	+3·2	+1·1	+2·4	+1·4	+1·6	—2·9	—3·6	+0·1	—4·0	+0·7	+0·1
Argentina N. (7 stations)	10	+2·8	+1·4	—0·9	+0·5	+1·4	+4·8	+3·6	+0·9	—0·7	—0·5	—2·1	—2·0	+0·8
Rio de Janeiro	64	—0·5	—1·3	+0·2	—1·8	—2·5	+3·1	+3·2	+1·3	+2·7	+0·4	+2·3	—1·6	+0·4
S. AFRICA.														
Cape Town	73	—1·1	+0·3	+0·5	—0·6	+1·5	—0·6	+1·8	—1·4	—0·1	+2·9	+1·7	—1·6	+0·2
Johannesburg	11	**+3·0**	+1·7	**+2·1**	**+2·5**	+1·6	—0·5	+1·4	**—3·4**	**+4·9**	+1·9	—1·7	+0·8	**+1·1**
MEAN	37	+0·4	+0·7	+1·1	+0·4	+0·3	+0·6	+0·5	+0·6	+0·2	+1·1	—0·5	—0·9	+0·3
St. Helena	23	**+3·2**	+1·7	+0·9	0·0	+0·2	+0·6	+1·2	+1·1	+1·3	+1·8	+1·4	+1·8	+1·3
Christmas Island	12	+1·7	+1·7	**+2·2**	—0·2	—0·8	—0·7	—0·9	+0·2	—0·1	**+1·9**	**+2·1**	+1·5	+0·7

TABLE III.—*Showing the Monthly and Annual Rainfall during* **1914**.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
AUSTRALIA.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in	inr	in.
Perth	·04	·83	·03	·75	1·82	5·66	4·44	2·36	·62	1·46	1·73	·47	20·21
Adelaide	1·07	·34	1·09	1·77	1·35	·65	1·39	·35	·60	·17	2·05	·58	11·41
Melbourne	1·45	·15	1·69	1·72	2·54	1·56	1·84	·66	1·09	·29	2·37	3·21	18·57
Sydney	·66	1·69	11·00	1·53	3·17	5·01	8·76	2·13	5·21	7·53	2·57	7·15	56·41
TASMANIA.													
Hobart	·24	·11	1·25	3·05	·97	·33	2·57	1·16	1·00	·39	1·66	2·69	15·42
NEW ZEALAND.													
Auckland	1·32	1·66	2·22	4·21	4·71	3·32	4·08	1·16	1·37	·97	1·41	1·77	28·20
Wellington	2·60	1·93	2·32	2·56	7·97	3·84	2·49	1·16	1·52	1·54	1·99	1·99	31·91
Hokitika	13·74	5·97	3·30	11·65	9·81	5·75	7.98	6·00	7·64	6·59	19·16	14·73	112·32
Dunedin	3·68	3·20	1·79	3·46	2·63	2·78	2·13	·74	1·69	1·81	3·48	3·92	31·31
SUB-ANTARCTIC.													
South Orkneys	1·65	2·05	2·09	2·40	1·38	1·57	1·30	·83	·71	1·30	1·03	1·49	17·80
South Georgia	3·41	2·51	2·14	5·81	3·35	4·51	6·45	4·41	1·38	—	—	—	—
SOUTH AMERICA.													
Punta Arenas	1·31	·99	·97	1·74	2·47	·88	(·48)	·35	·94	·52	·75	2·35	(13·75)
Evangelists Island	9·26	16·54	14·09	19·73	11·38	5·59	3·70	6·57	7·29	6·07	6·77	10·83	117·82
Point Galera	5·04	1·18	1·73	2·80	13·94	18·15	14·21	6·22	12·28	2·76	6·69	2·56	87·56
Valdivia	6·38	·39	2·48	2·52	20·16	25·16	21·46	10·24	15·91	2·96	7·95	2·76	118·37
Concepción	2·13	·00	1·69	2·40	5·99	15·55	16·66	5·75	8·07	3·07	3·35	·75	65·41
Santiago de Chile	·00	·00	·00	·24	2·30	8·09	4·92	2·92	4·02	2·83	2·26	·00	27·58
Ajo (Argentina)	5·85	3·77	6·80	14·87	4·91	5·36	4·53	6·93	3·91	4·49	6·58	3·15	71·15
Rio de Janeiro	2·59	6·69	1·79	8·38	1·25	·03	·09	·17	1·49	4·29	2·74	6·32	35·83
WEST INDIES.													
Trinidad	·50	·61	1·28	1·01	2·05	7·34	5·05	9·15	7·80	6·14	7·61	5·58	54·12
Grenada	1·80	2·09	2·61	2·59	3·95	6·85	6·72	6·86	6·63	8·44	7·77	5·56	61·87
S. ATLANTIC.													
St. Helena	3·54	4·33	6·07	5·44	5·16	3·71	3·39	5·57	3·68	1·48	3·67	3·17	49·21
SOUTH AFRICA.													
Cape Town	2·42	·33	·33	1·62	2·48	3·97	4·30	4·38	3·05	·55	1·09	·51	25·03
Johannesburg	2·71	3·09	2·93	·51	·40	·19	·00	·80	·11	2·25	6·86	7·69	27·54
Kimberley	·98	1·91	1·87	1·79	1·60	·56	·00	·36	·95	2·01	2·33	4·47	18·83
Christmas Island	·91	3·93	11·63	13·10	17·41	11·44	·94	·77	·19	·03	5·15	9·76	75·26

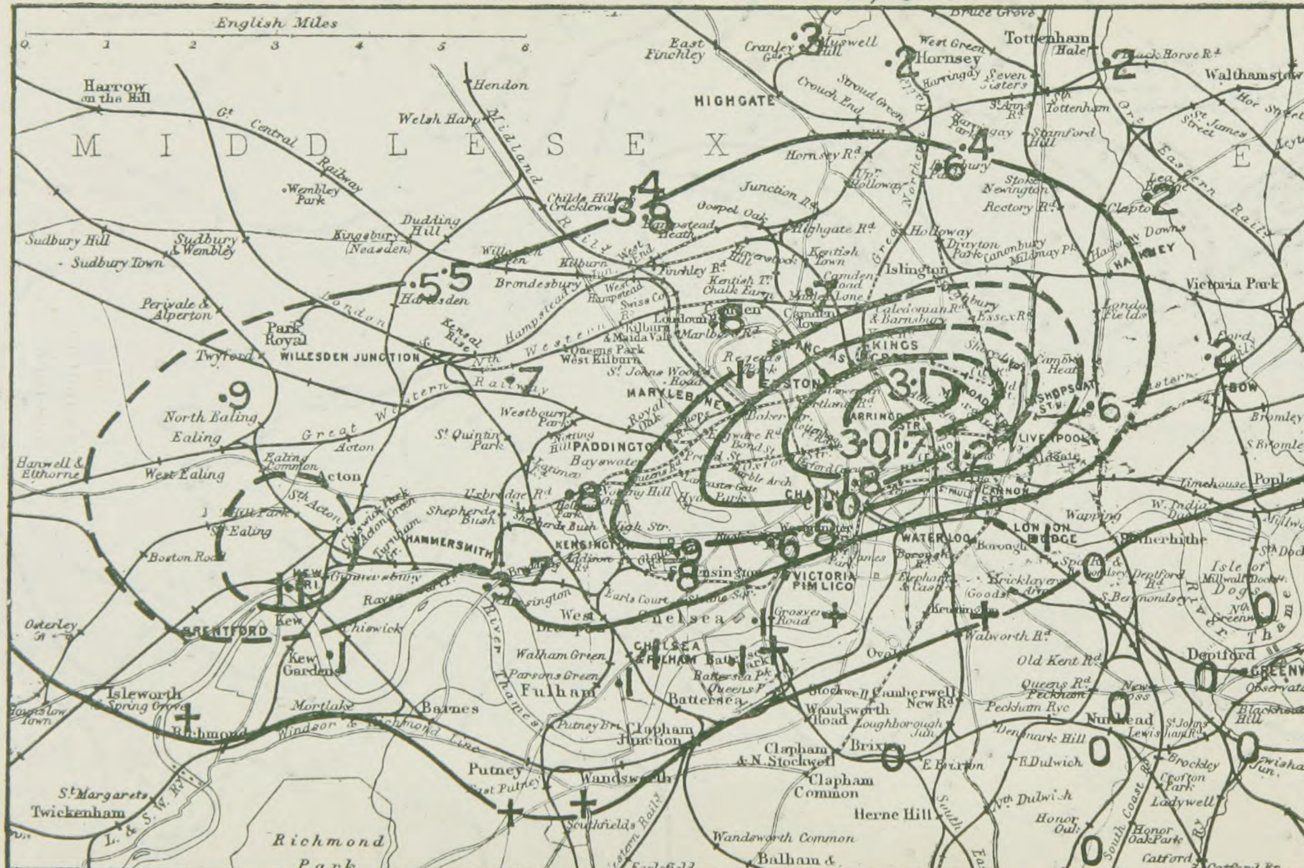
THAMES VALLEY RAINFALL ——— MAY, 1915.

Symons's Meteorological Magazine

Watershed of River Thames above Teddington and River Lea above Feildes Weir

Rainfall Stations reporting
Isohyetals

RAINFALL OF MAY 6TH, 1915.



The rainfall is given to the nearest tenth of an inch. A cross indicates that the fall was from ·01 to ·05 in. Where the position of the lines is not clearly established they are broken.

rainfall expressed as a percentage of the normal (Table IV.) Except in Table III. values which constitute an extreme record for the month and place in question are shown in heavy type. In Table II. a general mean temperature departure for the Southern Hemisphere between latitudes 23° and 61° S. is given, based on the returns from 16 stations and the two Argentine district values.

(To be continued.)

THE LONDON THUNDERSTORM OF MAY 6th.

THE severe thunderstorm of May 6th, described by Mr. Bonacina on p. 63 of our last number, was accompanied by a very heavy rainfall in a small district in the centre of London. Unfortunately the small number of rainfall records kept in the Metropolitan area makes it impossible to map out such a fall with the minuteness necessary to determine the exact area affected. We were rung up at Camden Square between 10 and 11 p.m., on the evening of May 6th, by two newspapers asking for particulars of the storm, and the enquiring journalists were both greatly impressed by the terrific downpour of rain which had occurred for more than an hour in the neighbourhood of Fleet Street. On consulting the recording rain gauge at Camden Square we found that only ·72 in. had fallen, a small amount considering the intensity of the electrical display.

Now that full returns are available it has been possible to plot a map, which is published herewith, showing very clearly the southern limit of the rain area, no rain having been observed south of a line drawn from Richmond, through Wandsworth and Poplar to Ilford. On the north and west the rainfall faded away gradually, less than a quarter of an inch having been reported from stations north of Hornsey and Hendon. The area with more than half an inch extended roughly from Ealing to Clapton, from west to east, and from Waterloo station to Finsbury Park, from south to north. The one-inch area was probably broken into two portions, the smaller in the neighbourhood of Kew Bridge, the larger extending for about six miles from Kensington to Hackney, and for about 2½ miles from the Thames on the south to Islington on the north. These lines are all well supported, but as the most interesting area is approached we enter the region where rain gauges become extremely rare. The line of 1·50 in. has been drawn with a very fair degree of approximation. It runs on the whole about half a mile inside the one-inch line. Only four rainfall records have been received from the six square miles which lie within it. These are 1·70 in. at Messrs. Negretti and Zambra's premises at Holborn Viaduct; 1·76 in. at Mr. Steward's, in the Strand; 3·00 in. at the Holborn Borough Stone Yard; and 3·12 in

at New River Head, the office of the Northern District of the Metropolitan Water Board. From these figures it is not very easy to draw exact isohyets of 2 and 3 inches, but following the only guide, parallelism with the outer isohyets, we have delineated the areas shown on the map. It is probable that more than 2 inches fell within the oval bounded on the west by Piccadilly Circus, on the east by Shoreditch, on the south by the Strand, and on the north by Euston Road. More than 3 inches of rain possibly fell on an area, perhaps half a mile wide and a mile and a half long, between the City and King's Cross. We cannot say with certainty that more than 3 inches fell in every part of this area, but we are fairly satisfied that more than 3 inches did not have a wider incidence, and we are of course unable to say whether at some place within the 3-inch line, the rain may not have been considerably heavier than at either of the two stations quoted.

Such very heavy falls of rain as 3 inches in less than 1½ hours have always to be viewed with a severely critical eye, as mistakes are most frequent in the measurement of the rarest falls, and the higher the reading, the less possible is it to obtain support from neighbouring observations. We are exceedingly fortunate in this case to have two official records, which are checked monthly by comparison with the other London stations, and there can be no doubt whatever as to their accuracy. The Observers were fully alive to the remarkable nature of the fall and the following communication from Mr. J. M. Wood, C.E., Engineer for the Northern District of the Metropolitan Water Board, shows how carefully he went into the matter.

"On Thursday evening the 6th instant, I recorded 3·12 in. of rain between 8.30 p.m. and 10 p.m., due to the thunderstorm. There can be no doubt about the time and quantity, as I had the rain gauge checked by tanks and trucks which stood close by. I thought perhaps you might like to record this."

We have not had time to examine all the London rain records in order to make a complete list of falls exceeding 3 inches in a rainfall day, but, so far as our memory serves, the only instances of rainfalls appreciably exceeding those recorded on May 6th, were the falls of (i.) 3·28 in. in an hour and a half, at Camden Square, on June 23rd, 1878 (the period during which rain fell was only 58 minutes); (ii.) 3·42 in. at Blackheath, on July 23rd, 1903, a long-continued rain; and (iii.) 3·90 in. at Haverstock Hill, on April 10th, 1878, also a long-continued fall. The rainfall, therefore, cannot be said to be unprecedented, either in amount or in intensity for the London area.

As an argument for the closer planting of rain gauges in great centres of population, we may point our how easily this great fall might have been missed, indeed if the two rain gauges recording it had been displaced by half a mile we might not have known that even so much as 2 inches of rain had fallen in London on May 6th.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on May 19th, at the Surveyors' Institution, Westminster, Major H. G. Lyons, F.R.S., President, in the Chair.

A paper was read on "The Wet English Winter of 1914-15" by Dr. H. R. Mill, and Mr. H. E. Carter. The area dealt with was restricted to England and Wales. The rainfall for each of the four months, November, 1914, to February, 1915, was plotted on large scale maps and isohyetal lines were drawn in the usual way. The data for November and December were very full and comprised about 1700 points. The maps for January and February were rather less complete, being drawn from about 750 points. In the case of December, the wettest month of the winter, a detailed comparison was made with the wettest Decembers of the last half century and the general rainfall calculated by measurement on the maps. In the other three months the general rainfall was obtained by the rougher statistical method of taking the mean of 27 stations uniformly distributed over the country. The results compared with the averages, were as follows :—

	1914-15. in.	Average in.	1914-15 as per cent. of Average.
November ...	4·65	3·46	134
December ...	7·37	3·49	211
January ...	4·35	2·94	148
February ...	4·93	2·49	198

The general rainfall of the four wettest Decembers was :—

	1868.	1876.	1911.	1914.
December ...	7·39	7·24	7·03	7·37

The close similarity in these results is remarkable and seems to suggest a limiting value. The rainfall of the whole period, November, 1914, to February, 1915, was compared with the average by the cartometric method, an average rainfall map for the four months being specially prepared for this purpose. The period was further compared with the two previous wettest four-monthly periods in the past 55 years, viz., November, 1876—February, 1877, and October, 1911—January, 1912, the results being :—

	General Rainfall over England and Wales.	General Rainfall as a Percentage of the Average.
Nov. 1876 to Feb. 1877 ...	19·50	161
Oct. 1911 to Jan. 1912 ...	18·67	131
Nov. 1914 to Feb. 1915 ...	20·21	167

Thus the rainfall of the four months, November, 1914, to February, 1915, over England and Wales as a whole, was ·71 in. greater than the next wettest four months in any winter since the late Mr. G. J. Symons commenced the systematic collection of rainfall data. An interesting feature of the map showing the relation of the rainfall to the average in the past winter was that the Lake District and South Wales, the districts of highest rainfall, were

relatively the driest for the four months, while the south-east of England was relatively the wettest part of the country. A large area with more than twice the average fall extended from Hertford to the south coast covering most of the south-eastern counties and a smaller area with twice the average lay over Shropshire.

Dr. W. N. Shaw, Mr. R. C. Mossman, Mr. C. Harding, Mr. W. W. Bryant, Mr. R. H. Hooker, Mr. C. Salter, and Mr. E. Gold took part in the discussion on the paper.

Mr. J. E. Clark presented the "Report of the Phenological Observations from December, 1913, to November, 1914." The Report was based on the observations made at 133 stations, an increase of 6 on the previous year. All the 13 standard plants were in flower earlier than usual. The dominating factors were the abmornally mild autumn of 1913, the mild winter and the remarkably genial April weather. Fruits and crops were prejudiced by the serious May frosts and the droughty conditions from April to October. On the other hand the sunny warmth of the autumn largely countervailed to make the year successful for the farmer and partially so to fruit growers. A new feature in the Report was the introduction of a migrant table.

Mr. R. H. Hooker, who had previously collaborated with Mr. Clark in the preparation of the Report, presented some results of the agricultural returns. Generally speaking, crops were rather bad in the extreme south-east of the country and good in the extreme north-west, but differed little from the average.

Lt.-Col. Mellish spoke as to the disastrous frosts of May.

The following gentlemen were elected Fellows of the Society: Mr. Andrew Cheung, and Mr. James A. Yates.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WET MAY IN KENT.

THAT two such excessive falls of rain as 1·55 in. on the 13th and 1·48 in. on the 17th should occur in May is quite unprecedented at this station. During 50 years only three dates show falls over an inch, 1·30 in. on May 7th, 1878; 1·61 in. on May 28th, 1879; and 1·34 in. on May 12th, 1886. There have only been eight Mays during 52 years with over three inches.

1865	3·24 in.	1886	3·34 in.
1869	4·04 ,,	1891	3·12 ,,
1878	4·22 ,,	1898	3·44 ,,
1879	3·61 ,,	1915	3·65 ,,

Curiously the wet May of 1898 came in the driest year of the fifty. The fifty years' average for May is 1·76 in., but for the ten years ending 1913, only 1·46 in.; my first twenty years, 1864-83, had an average of 2·10 in.

J. E. MACE.

View Tower, Tenterden, June 1st, 1915.

THUNDERY WEATHER ON MAY 21st.

I SHALL be interested to know whether any readers can report the occurrence of heavy thunderstorms on Friday, May 21st, along the Thames between Reading and London. The general conditions that day were very thundery, as the following notes made on a journey from London to Devonshire show.

At noon, on leaving Paddington, atmosphere warm and close; sky cloudy, with tendency towards cumulus development; West Drayton, heavy thunder clouds developing; between Slough and Maidenhead the express passed through what to all appearances was a thunderstorm, but I did not see any lightning, and thunder is of course, difficult to hear in a train, unless very severe; 0.36 p.m., Reading, rain had ceased, but the heavy black and purple shades were still throwing the elms into exquisitely beautiful relief; 1.30, Lavington, Wiltshire, half-way to Exeter, atmosphere fresher and brighter, with fiercely hot sunshine, but a gigantic most imposing pile of cumulus lay over the Marlborough Downs; 2.15, Athelney, Sedgmoor district of mid-Somerset, fine and sunny, small innocent-looking clouds; 3.0 p.m., first stop, Exeter, sky again looking thundery; Dawlish and Teignmouth, thick fog rolling in from the sea, very depressing after the rich warm thunder hues of the Thames valley; 4.0 p.m., Torbay district, fog gone, but conditions close and thundery, rather heavy rain for two or three hours in the evening. L. C. W. BONACINA.

May 26th, 1915.

THE SEASONS—THIRD REJOINDER.

BEFORE withdrawing from this protracted controversy, I wish to re-assert that, whatever meanings may be variously attached for certain special purposes to the expression "summer" and "winter," the outstanding fact remains that the solstitial trios May, June, July, and November, December, January, form—as regards the preponderance of atmospheric effects depending upon the interaction of the several meteorological and astronomical factors—unmistakeable *family* groups. Concerning that particular element, the mean temperature of the air, whose seasonal maximum and minimum lag behind the solstices so as to be displaced towards the succeeding equinoctial periods, this may be analysed as the combined effect of direct incoming radiation and of the store of heat already present in the soil and air. If the relative power of the sun in the twelve months of the year be represented on the scale of units from 1 to 12, then that of June will be 12, July 11, May 10, and August 9. The income of heat and light in August is, therefore, smaller than in any of the three previous months of higher sun and longer days; yet in consequence of the large

capital of heat which the earth has accumulated during May, June, and July, the mean air temperature of August is second only to July's, simply because the weaker sun has the advantage of shining upon an already heated surface. But there are ever so many atmospheric or meteorological influences apparent to acute observation which harmonize with the different physical origin of equinoctial warmth. The same applies inversely in relation to the cold of the winter solstice and vernal equinox.

To conclude with a concrete illustration. I was travelling up from the west of England on the glorious summer evening of May 24th, and at that magic hour between 8 and 9, when the shaggy elms were looming black and huge in the still, warm air, and the whole northern sky was a sheen of golden twilight, I could not help contrasting the magnificent summer scene with the darkness and associated dampness and chilliness of the same hour on the 24th August, and deploring the extraordinary lack of perception which would, on the mere ground of a higher average temperature, have August instead of May share the illustrious summer company of June and July. There is room for August in a summer *quartette*, but not in a summer *trio*.

Finally, I think our rich heritage of English literature suggests that the man of letters, perceiving the general effects of nature, can drop a hint to the meteorologist concerning the most philosophical arrangement of the seasons.

L. C. W. BONACINA.

June 3rd, 1915.

REMARKABLE MID-MAY SNOWSTORM.

We had a remarkable mid-May snowstorm in this district on the 13th, after two dry months, March and April, with a combined rainfall of only 1·82 in. Rain set in from the north-east about 3 p.m. on May 12. The temperature which had been 60° in the morning, fell to 45° by 5 p.m. The rain was not heavy till after daylight on the 13th, ·88 in. being measured at 9 a.m. on that date. The maximum temperature on the 13th barely reached 43°, the lowest May maximum I have any record of and the rain, which was continuous, about 8.30 p.m. turned to snow; at 9 p.m. the ground was white and the temperature 32°. The snow ceased between 11 and midnight, and the ground remained white till about 4 a.m. on the 14th, *i.e.*, seven hours. As the sky remained overcast the temperature did not decline below 32°. Ganway Hill, 1,200 feet, was covered with snow till after mid-day on the 14th, and parts of the Black Mountains were white all through the 14th, in spite of abundant sunshine. The gauge showed 1·10 in. at 9 a.m. on the 14th, so that the total fall was 1·98 in. Practically all the fall was snow above 1,500 feet on the Black Mountains, and above 2,000 feet this snow

lay a foot or more in average depth on the morning of the 14th, after 24 hours continuous snowfall. On May 15th I was on the part of the range which forms the highest ground in Herefordshire, viz., 2,300 feet. At this height it was all patchy with snow (two days after the storm) and the deepest drift I encountered was five feet, though as the drift was some hundreds of yards long it may have been deeper in places. I have known the ground to be white from hail and snow showers in the last week in May, and have seen the Clee hills white on May 30th, in 1894, from this cause, but continuous snow, from a cyclonic depression in mid-May (as distinguished from hail and snow showers of the north-west type), is a very different matter, and entirely uncommon at such a late date. The snowfall of the 13th seemed to fall off to the west rapidly, and I could see no snow on Plinlimmon or even the Brecon Beacons, though it was too hazy to speak with certainty; anyhow, the River Wye never rose, which confirms this supposition. Radnor Forest had a few drifts; drifts could also be seen from the Black Mountains on the 15th on the top of the Clee and Malvern Hills, more on the latter, although lower, than on the more northerly Clee group. The fall for the two days at 1,200 ft., on the Black Mountains, was 1·17 in., compared with 1·98 in. here about 12 miles further east. Early on the 15th the exposed thermometer four feet above ground, fell to 23°, and much damage was done.

R. P. DANSEY.

Kentchurch Rectory, Hereford, May 17th, 1915

METEOROLOGICAL NEWS AND NOTES.

THE LIST OF KING'S BIRTHDAY HONOURS includes the gratifying announcement that a knighthood has been conferred on Dr. W. N. Shaw, F.R.S., Director of the Meteorological Office. This is, we believe, the first instance in which a similar honour has been conferred on the head of the national weather service.

THE DEATH OF MR. AKSEL S. STEEN, Director of the Norwegian Meteorological Institution, took place in Christiania on May 10th. Mr. Steen only recently succeeded the veteran meteorologist, Professor Mohn, in the position he held so long.

THE SEARCH FOR AN EARTHLY PARADISE seems still to have some votaries; the most remarkable feature in the following advertisement which recently appeared in *The Times* is the suggestion that it is to be looked for so near London :—

"Advertiser, suffering from heart trouble, wishes to reside in a district where thunder is practically unknown, within three or four hours of London, and where some rough shooting and fishing can be obtained. . . . ."

RAINFALL TABLE FOR MAY, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	1·75	3·72
Tenterden	*Kent*	51 4	*0 41	190	1·65	3·65
Arundel (Patching)	*Sussex*	50 51	0 27	130	1·80	4·34
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	1·96	3·68
Oxford (Magdalen College).	*Oxfordshire*	51 45	1 15	186	1·81	3·27
Wellingborough(Swanspool)	*Northampton*	52 18	0 41	155	1·98	1·78
Shoeburyness	*Essex*	51 31	*0 48	13	1·27	2·58
Bury St. Edmunds(Westley)	*Suffolk*	52 15	*0 40	226	1·93	1·61
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	1·78	2·08
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	2·08	2·68
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·02	2·24
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·10	2·42
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·64	3·42
Boston	*Lincolnshire*	52 58	0 1	11	1·80	1·59
Worksop (Hodsock Priory).	*Nottinghamshire*	53 22	1 5	56	2·08	1·39
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·10	1·76
Macclesfield	*Cheshire*	53 15	2 7	501	2·43	1·33
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	2·13	1·31
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	3·55	1·51
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·09	1·57
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	1·98	1·47
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·04	2·01
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	7·50	1·18
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	2·56	2·62
Haverfordwest	*Pembroke*	51 48	4 58	90	2·62	2·56
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	2·63	2·92
Llandudno	*Carnarvon*	53 20	3 50	72	1·86	2·02
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	2·87	1·59
Marchmont House	*Berwick*	55 44	2 24	498	2·53	1·67
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	2·98	1·70
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	2·40	1·40
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	3·53	1·06
Mull (Quinish)	,,	56 34	6 13	35	2·99	·82
Dundee(EasternNecropolis)	*Forfar*	56 28	2 57	199	2·05	·96
Braemar	*Aberdeen*	57 0	3 24	1114	2·33	·82
Aberdeen (Cranford)	,,	57 8	2 7	120	2·40	·88
Gordon Castle	*Moray*	57 37	3 5	107	2·10	1·26
Fort Augustus(S. Benedict's)	*E. Inverness*	57 9	4 41	68	2·36	·81
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	4·54	1·41
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·19	1·08
Wick	*Caithness*	58 26	3 6	77	2·04	·52
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	3·05	2·24
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	2·33	2·81
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	2·51	1·34
Ennistymon House	*Clare*	52 57	9 18	37	2·70	·89
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·24	2·56
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·43	·92
Dublin(FitzWilliamSquare)	*Dublin*	53 21	6 14	54	2·07	1·60
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	2·51	1·20
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	3·17	1·96
Cong (The Glebe)	,,	53 33	9 16	112	2·94	1·38
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	2·80	1·48
Seaforde	*Down*	54 19	5 50	180	2·72	2·60
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	2·37	·72
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	2·66	·90

RAINFALL TABLE FOR MAY, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.				Mean Annual 1875–1909.	STATION.
Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1875—1909.	1915.	Diff. from Aver.	% of Av.		
in.		in.	Date.		in.	in.	in.		in.	
+1·97	213	1·37	13	8	8·68	13·25	+4·57	153	25·11	Camden Square
+2·00	221	1·55	13	9	9·41	13·46	+4·05	143	27·64	Tenterden
+2·54	241	2·20	13	9	10·33	16·48	+6·15	159	30·48	Patching
+1·72	188	1·40	13	10	11·14	15·47	+4·33	139	31·87	Cadland
+1·46	181	1·01	13	10	8·33	11·17	+2·84	134	24·58	Oxford
— ·20	90	·91	13	8	9·08	8·40	— ·68	93	25·20	Swanspool
+1·31	203	1·00	13	7	6·23	7·95	+1·72	128	19·28	Shoeburyness
— ·32	83	1·02	13	9	8·55	9·67	+1·12	113	25·40	Westley
+ ·30	117	1·31	13	13	7·84	11·08	+3·24	141	23·73	Geldeston
+ ·60	129	·56	13	12	13·70	18·59	+4·89	136	38·27	Polapit Tamar
+ ·22	111	·61	12	11	12·15	13·09	+ ·94	108	33·54	Rousdon
+ ·32	115	·75	13	9	10·65	12·58	+1·93	118	29·81	Stroud
+ ·78	130	·77	17	10	11·71	16·03	+4·32	137	32·41	Wolstaston
— ·21	88	·51	13	9	7·91	8·02	+ ·11	101	23·35	Boston
— ·69	67	·44	11	9	8·74	7·96	— ·78	91	24·46	Hodsock Priory
— ·34	84	·44	1, 13	9	9·22	8·66	— ·56	94	26·65	Mickleover
—1·10	55	·54	1	7	11·91	13·91	+2·00	117	34·73	Macclesfield
— ·82	61	·41	11	12	10·70	12·38	+1·68	116	32·70	Southport
—2·04	43	·65	11	11	23·59	26·23	+2·64	111	61·49	Arncliffe
— ·52	75	·86	11	5	9·46	10·76	+1·30	114	26·87	Ribston Hall
— ·51	74	·37	1	9	8·99	9·70	+ ·71	108	26·42	Hull
— ·03	99	·67	11	11	9·51	9·60	+ ·09	101	27·94	Newcastle
—6·32	16	·59	11	7	49·44	53·44	+4·00	108	129·48	Seathwaite
+ ·06	102	·62	13	17	14·67	15·43	+ ·76	105	42·28	Cardiff
— ·06	98	·65	19	12	16·71	18·55	+1·84	111	46·81	Haverfordwest
+ ·29	111	1·31	1	14	15·15	20·76	+5·61	137	45·46	Gogerddan
+ ·16	109	·53	17	10	10·40	12·10	+1·70	116	30·36	Llandudno
—1·28	55	·55	11	8	16·22	21·52	+5·30	133	43·47	Cargen
— ·86	66	·60	11	8	12·00	9·58	—2·42	80	33·76	Marchmont
—1·28	57	·90	12	8	18·06	22·97	+4·91	127	49·77	Girvan
—1·00	58	·59	28	7	13·10	11·60	—1·50	89	35·97	Glasgow
—2·47	30	·43	11	7	25·68	29·62	+3·94	115	68·67	Inveraray
—2·17	27	·22	31	10	20·25	23·47	+3·22	116	56·57	Quinish
—1·09	47	·22	11	12	9·96	9·65	— ·31	97	28·64	Dundee
—1·51	35	·35	11	9	12·97	16·15	+3·18	124	34·93	Braemar
—1·52	37	·21	11	11	12·00	11·81	— ·19	98	32·73	Aberdeen
— ·84	60	·25	11	14	10·14	12·37	+2·23	122	30·34	Gordon Castle
—1·55	34	·20	11	9	18·15	14·58	—3·57	80	44·53	Fort Augustus
—3·13	31	·35	31	8	33·48	34·63	+1·15	103	83·93	Bendamph
—1·11	49	·36	10	9	12·18	...	...	...	31·90	Dunrobin Castle
—1·52	26	...	...	...	10·88	9·32	—1·56	86	29·88	Wick
— ·81	73	·50	15	13	21·95	21·67	— ·28	99	54·81	Killarney
+ ·48	121	·85	16	10	14·61	13·54	—1·07	93	39·57	Waterford
—1·17	53	·76	15	8	14·81	14·68	— ·13	99	39·43	Castle Lough
—1·81	33	·28	15	8	16·49	18·13	+1·64	110	46·52	Ennistymon
+ ·32	114	·50	15	9	12·83	12·00	— ·83	94	34·99	Courtown Ho.
—1·51	38	·30	15	8	13·26	12·00	—1·26	90	35·92	Abbey Leix
— ·47	77	·61	17	12	10·15	9·50	— ·65	94	27·68	Dublin
—1·31	48	·40	16	9	13·29	14·88	+1·59	112	36·15	Mullingar
—1·21	62	·39	16	13	20·21	20·76	+ ·55	103	52·87	Enniscoe
—1·56	47	·35	18	13	18·23	18·12	— ·11	99	48·90	Cong
—1·32	53	·67	21	9	15·72	17·89	+2·17	114	42·71	Markree
— ·12	96	·94	19	10	14·54	14·76	+ ·22	102	38·91	Seaforde
—1·65	30	·56	11	3	12·93	10·53	—2·40	81	37·56	Dundarave
—1·76	34	·33	11	9	14·28	14·23	— ·05	100	39·38	Omagh

SUPPLEMENTARY RAINFALL, MAY, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road	3·17	XI.	Lligwy	1·85
,,	Ramsgate	2·91	,,	Douglas	1·83
,,	Hailsham	3·94	XII.	Stoneykirk, Ardwell House	1·45
,,	Totland Bay, Aston House	3·14	,,	Carsphairn Shiel	1·55
,,	Stockbridge, Ashley	4·22	,,	Beattock, Kinnelhead	1·56
,,	Grayshott	4·00	,,	Langholm, Drove Road	2·15
III.	Harrow Weald, Hill House	2·51	XIII.	Meggat Water, Cramilt Lodge	1·45
,,	Caversham, Rectory Road	3·10	,,	North Berwick Reservoir	1·36
,,	Pitsford, Sedgebrook	1·02	,,	Edinburgh, Royal Observaty.	1·34
,,	Woburn, Milton Bryant	1·91	XIV.	Maybole, Knockdon Farm	1·00
,,	Chatteris, The Priory	1·36	XV.	Ballachulish House	1·08
IV.	Elsenham, Gaunts End	2·09	,,	Campbeltown, Witchburn	1·89
,,	Colchester, Hill Ho., Lexden	2·09	,,	Holy Loch, Ardnadam	2.01
,,	Ipswich, Rookwood, Copdock	2·24	,,	Islay, Eallabus	1·35
,,	Blakeney	1·49	,,	Tiree, Cornaigmore	·67
,,	Swaffham	1·34	XVI.	Dollar Academy	1·71
V.	Bishops Cannings	3·29	,,	Balquhidder, Stronvar	1·85
,,	Wimborne, St. John's Hill	2·80	,,	Glenlyon, Meggernie Castle	1·70
,,	Ashburton, Druid House	4·22	,,	Blair Atholl	1·07
,,	Cullompton	2·01	,,	Coupar Angus	·99
,,	Lynmouth, Rock House	1·92	,,	Montrose, Sunnyside Asylum.	·89
,	Okehampton, Oaklands	2·72	XVII.	Alford, Lynturk Manse	1·17
,,	Hartland Abbey	2·57	,,	Fyvie Castle	·75
,,	Probus, Lamellyn	2·15	,,	Keith Station	2·15
,,	North Cadbury Rectory	2·51	XVIII.	Rothiemurchus	1·36
VI.	Clifton, Pembroke Road	3·07	,,	Loch Quoich, Loan	3·50
,,	Ross, The Graig	3·36	,,	Drumnadrochit	1·30
,,	Shifnal, Hatton Grange	2·36	,,	Skye, Dunvegan	·98
,,	Droitwich	2·42	,,	Lochmaddy, Bayhead	·86
,,	Blockley, Upton Wold	2·72	,,	Glencarron Lodge	1·31
VII.	Market Overton	2·33	XIX.	Invershin	1·04
,,	Market Rasen	1·66	,,	Melvich	1·25
,,	Bawtry, Hesley Hall	1·38	,,	Loch Stack, Achfary	2·12
,,	Derby, Midland Railway	1·73	XX.	Dunmanway, The Rectory	2·91
,,	Buxton	1·62	,,	Glanmire, Lota Lodge	2·76
VIII.	Nantwich, Dorfold Hall	2·30	,,	Mitchelstown Castle	1·62
,,	Chatburn, Middlewood	1·71	,,	Darrynane Abbey	3·49
,,	Lancaster, Strathspey	1·23	,,	Clonmel, Bruce Villa	1·96
IX.	Langsett Moor, Up. Midhope	1·78	,,	Newmarket-on-Fergus, Fenloe	1·04
,,	Scarborough, Scalby	1·77	XXI.	Laragh, Glendalough	1·49
,,	Ingleby Greenhow	1·76	,,	Ballycumber, Moorock Lodge	·57
,,	Mickleton	1·70	,,	Balbriggan, Ardgillan	1·44
X.	Bellingham, High Green Manor	2·83	XXII.	Ballynahinch Castle	1·61
,,	Ilderton, Lilburn Cottage	1·45	,,	Woodlawn	1·07
,,	Keswick, The Bank	·91	,,	Westport, St. Helens	1·06
XI.	Llanfrechfa Grange	3·65	,,	Dugort, Slievemore Hotel	·66
,,	Treherbert, Tyn-y-waun	4·68	,,	Mohill Rectory	·92
,,	Carmarthen, The Friary	1·74	XXIII.	Enniskillen, Portora	1·07
,,	Fishguard Goodwick Station.	1·64	,,	Dartrey [Cootehill]	·63
,,	Crickhowell, Tal-y-maes	4·20	,,	Warrenpoint, Manor House	1·47
,,	New Radnor, Ednol	5·35	,,	Banbridge, Milltown	1·22
,,	Birmingham WW., Tyrmynydd	5·05	,,	Belfast, Cave Hill Road	1·19
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	1·03
,,	Llangynhafal, Plâs Draw	1·99	,,	Londonderry, Creggan Res.	1·27
,,	Dolgelly, Bryntirion	2·77	,,	Dunfanaghy, Horn Head	1·83
,,	Bettws-y-Coed, Tyn-y-bryn	...	,,	Killybegs	1·56

THE WEATHER OF MAY.

THE weather was generally fine and dry at the beginning of the month with occasional local thunderstorms in nearly all parts of Great Britain. On the evening of the 6th a severe storm passed across London from west to east, following a brilliantly sunny and warm day. More than 3·00 in. of rain fell in Clerkenwell, where the storm was most severe, while in the south of London there was practically none. The City streets were flooded and at West Kensington Station, on the District Railway, the water was several feet deep and traffic was suspended for some time. During a violent local thunderstorm at Leek on the following day, hail and rain amounting to 1·75 in. fell in an hour, from 5.30 to 6.30. p.m. A cold, northerly type of conditions set in over Scotland on the 11th and spread over the whole country by the 13th or 14th. On the 13th the shade maximum temperature at Oxford was only 44°, the lowest ever recorded in May, and shade minima below 30° were reported from nearly all parts of the British Isles between the 13th and 15th, and fruit trees were much damaged by the frost. At Balmoral the value was 21°, and at Eskdalemuir 22°. The 13th was also characterized by very widespread rain, with some snow in the Midland Counties of England and over Scotland. The falls were heaviest in the south-east of England, where the rain was practically continuous for 24 hours, and exceeded 2·00 in. at many stations in Sussex. At Upton Wold the snow fell to a depth of 6 inches. A depression off the south of Ireland on the 17th extended slowly eastward, and occasioned heavy rain over the southern counties of England. Many widely distributed stations had more than 1·50 in., and in Hampshire the fall was only just below 2·00 in. at several places and exactly this amount at Faccombe Manor. Anticyclonic conditions set in generally about the 20th and the weather was fine and dry to the end of the month. Practically no rain fell over the south of England and the greater part of Ireland. Temperature rose considerably and was above 75° in nearly all parts of the British Isles and reached 80° at Fort William and Gordon Castle on the 24th, and at Salisbury on the 25th and 26th. A sudden drop in temperature occurred on the 27th, and on the following four days frosts occurred in many parts of England, causing injury to fruit and vegetable crops.

The rainfall of the month was very unevenly distributed. In England it was heaviest in the south and south-east, there being many areas with more than 4 in. south of the Thames. Less than 2 in. fell along the whole of the east coast north of the Wash and a remarkable feature was that the fall only just exceeded this amount in what is normally the wettest part of the Lake District. Over Wales the fall was about the average. In Scotland the rainfall was very light, being less than 2 in. over practically the whole country, and less than an inch in the north-east. In Ireland less than an inch fell over a great part of the central area and less than 2 in. everywhere, except in the exposed districts of the west and in the south and east. Over the Kingdom as a whole, the general rainfall expressed as a percentage of the average, was as follows: England and Wales, 101; Scotland, 43; Ireland, 62; British Isles, 74.

The duration of sunshine was everywhere considerable. The following amounts are reported: London (Camden Square), 201·0 hours; Margate, 217·0 hours; Worthing, 233·3 hours; Totland Bay, 242·0 hours; Copdock, 236·0 hours; Sidmouth, 205·3 hours; Ashbourne, 226·7 hours; Matlock Bath, 204·5 hours; Southport, 258·9 hours; Hull, 151·4 hours; Haverfordwest, 255·6 hours; Paisley Observatory, 209·0 hours; Loch Stack, 225·8 hours.

In London there were several dull days in the first half of the month, but on the whole the weather was fine, sunny and warm. No rain fell after the 18th. Mean temperature at Camden Square 55°·6, or 1°·6 above the average. Duration of rain, 52·7 hours. Evaporation, 2·90 in.

Climatological Table for the British Empire, December, 1914.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	55·6	2	28·7	23	47·0	37·6	39·3	89	75·8	24·7	6·34	24	8·2
Malta	66·2	16	49·8	28	58·2	54·3	...	89	140·0	...	1·07	11	2·2
Lagos	91·0	4	69·0	29	88·0	75·2	72·6	73	157·0	64·0	·67	5	5·3
Cape Town	85·4	31	46·5	21	75·3	56·9	54·8	66	...	...	·51	6	3·9
Natal, Durban ...	..	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	81·4	31	54·1	30	74·8	57·2	58·6	86	..	52·0	7·69	17	6·6
Mauritius	88·7	25	64·5	18*	83·9	69·8	65·5	69	...	58·7	1·98	16	5·5
Bloemfontein	90·7	31	53·2	25	82·5	60·4	56·1	59	...	...	7·00	7	4·3
Calcutta...	82·7	11	51·3	24	78·3	57·6	55·6	67	...	45·9	1·20	1	1·8
Bombay...	89·9	2	65·6	26	85·1	70·2	64·7	66	136·2	52·9	...	...	2·0
Madras	89·7	21	60·6	24	85·2	70·8	68·1	76	154·5	56·9	·77	4	4·2
Colombo, Ceylon ...	90·5	3	70·0	25	86·0	73·1	73·4	82	163·1	64·7	2·92	16	7·2
Hongkong	75·6	5	52·3	13	67·7	60·5	55·9	73	...	...	·72	5	7·5
Sydney	101·4	12	58·8	9	79·7	65·8	62·0	74	157·1	50·0	7·15	16	6·5
Melbourne	88·8	25	52·2	20	74·3	58·1	54·9	67	147·6	45·6	3·21	15	6·2
Adelaide	102·8	24	51·9	8	84·5	61·5	53·2	49	155·2	43·0	·58	5	4·8
Perth	96·6	16	51·3	23	81·7	61·4	56·3	65	165·6	42·3	·47	5	3·3
Coolgardie	104·8	11	50·0	24	88·8	63·2	55·5	49	180·0	46·0	·65	5	4·6
Hobart, Tasmania ...	78·8	10	42·9	7	64·5	51·4	46·5	64	147·0	32·3	2·69	14	6·8
Wellington	72·0	19	42·0	2	63·4	51·6	48·3	72	144·8	29·2	1·99	11	6·1
Auckland	74·0	7	48·5	20	67·2	53·9	51·9	73	147·0	43·0	1·77	12	6·0
Jamaica, Kingston ...	91·9	24	70·2	26	89·1	71·8	68·9	77	...	...	·23	5	3·3
Grenada	86·0	10	68·0	30	83·5	74·1	...	79	136·0	...	5·56	23	4·0
Toronto	53·8	2	-7·2	26	31·5	20·0	19·5	84	93·8	-20·0	1·76	13	6·7
Fredericton	47·0	1, 14	-22·5	25	27·6	8·6	...	81	...	...	1·96	7	3·9
St. John, N.B. ...	49·5	2	-10·3	26	30·9	15·8	17·4	72	...	...	2·59	8	4·0
Alberta, Edmonton ...	·7	31	-21·0	26	16·2	1·5	...	93	82·8	-30·0	1·10	17	6·8
Victoria, B.C.	49·1	7	29·9	12†	43·0	36·2	...	87	...	...	·59	10	6·4

* and 19. † and 13.

Johannesburg.—Bright sunshine 238·0 hours.

Mauritius.—Mean temp. 1°·2, dew point 2°·4, and R 2·88 in. below averages. Mean hourly velocity of wind 12·3 miles, or 1·5 miles above average.

Bloemfontein.—Rainfall highest for December ever recorded.

COLOMBO, CEYLON.—Mean temp. 79°·6 or 0°·4 above, dew point 1°·6 above, and R 2·08 in. below, averages. Mean hourly velocity of wind 5·9 miles.

HONGKONG.—Mean temp. 64°·0. Mean hourly velocity of wind 10·7 miles. Bright sunshine 111·4 hours.

Melbourne.—Mean temp. 1°·6 above average. Mean temp. for the year 59°·9.

Adelaide.—Mean temp. 1°·9 above, and R ·39 in. below, averages.

Coolgardie.—Temp. of air 0°·2 below, and R about normal.

Hobart.—Temp. of air 2°·5 below, and R ·77 in. above, averages.

Wellington.—Mean temp. 2°·8 below, and R 1·34 in. below, averages. Bright sunshine 273·5 hours.

Auckland.—Cool, cloudy, windy and dry. Rainfall, mean temp. and sunshine under average.

ALBERTA, EDMONTON.—Cold, damp, snowy and cloudy. Frosts every day except the last.

Symons's
Meteorological Magazine.

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"BRITISH RAINFALL, 1914."

The fifty-fourth annual volume of *British Rainfall*, compiled by Dr. H. R. Mill and Mr. Carle Salter, will be ready for distribution early in August. The editorial work is already completed save for revising the final proofs of the last sheets, and only the mechanical processes of printing and binding remain to be finished. The volume now on the verge of completion differs in appearance from its predecessors by being slightly wider and slightly thinner. The extra width enables the General Table of Annual Rainfall to be extended by the addition of a column giving the total rainfall for the year in millimetres as well as in inches, thus enabling anyone to whom millimetres are more familiar than inches, or in any way preferable, to utilize all the annual data, while those content with the old units are put to no inconvenience. The wider page has also facilitated the arrangement of several tables in the earlier parts of the volume and by allowing more words in the printed page it has materially reduced the thickness of the book.

The total number of stations dealt with is 5445, being 75 more than last year. The rate of increase is not so great as usual on account of the war; but it is surprising and gratifying that no falling off in the number has taken place. The Director's Report mentions the fact that the grant asked for from the Development Fund has been declined. The work of the Organization has been carried on as in former years. Mr. H. E. Carter, the chief computer, has joined the Army and his post is kept open for him.

In Part I. the original articles include a description of the remarkable thunderstorm of June 14th, 1914, and an account by Mr. J. Fairgrieve of the development of the rain-fields of the storm in different parts of the country with half-hourly maps. There is also an illustrated summary of the paper on Isomeric Rainfall Maps of the British Isles prepared by Dr. Mill and Mr. Salter for the Royal Meteorological Society. The enlarged page enables the discussion of monthly rainfall in Part II. to be slightly amplified.

SOUTHERN HEMISPHERE WEATHER IN 1914.

By R. C. Mossman, F.R.S.E.

(*Continued from p. 77.*)

No data from South Georgia for the last quarter of 1914 having yet come to hand, the monthly departures from the South Orkneys for this period have had double weight attached to them in computing the deviations. We may now summarise the more prominent features of last year's weather in the Southern Hemisphere month by month. In judging of the weight to be attached to instances in which a record is broken it is of course necessary to consider the period covered by the observations taken into consideration.

In January barometric pressure was in excess of the average very generally, but normal in a line stretching from Buenos Aires to Santiago de Chile. Temperature on the mean of all the stations was 0°·4 above the average. The month was the hottest on record at such widely separated places as Santiago, Johannesburg, and St. Helena, but was distinctly cool in South Australia, the north of New Zealand, and the far South Atlantic and adjacent Patagonian stations. The month was exceptionally dry in West Australia, New South Wales, Tasmania, the West Indies, and Christmas Island, and unusually wet in middle latitudes on the coast of Chile, in the Argentine Republic, east of 70° W, and between the latitudes of 35° and 40° S.

In February pressure conditions were on the whole in excess of the average, but at Wellington and the South Orkneys slightly under the normal. Temperature on the mean of all the stations was 0°·7 above the average, and while no records were broken, the month was very warm in South Australia and at Santiago, and cool in West Australia. Rainfall was generally under the average, the drought being most intense at Melbourne, Hobart, Valdivia and Christmas Island, the small rainfall at the latter station constituting an extreme record. On the other hand at Evangelists Island 16·54 in. fell, the maximum February fall hitherto observed, and in marked contrast to the drought noted on the Pacific coast some 700 miles to the north. The month was also wet in the province of Buenos Aires, at Rio, and at Perth.

In March barometric pressure was much in excess of the normal at the southern extremity of the South American continent, the excess diminishing to the S.E. and W, but elsewhere it did not deviate much from the average. Temperature was above the normal nearly everywhere, with extreme records at Johannesburg and Christmas Island, the general excess being 1°·1. The heat was specially marked in South Australia, and in Argentina, north of latitude 40° S., rather cool conditions prevailed. No rain records were broken, but there was a marked excess in New South Wales and on the littoral of the Province of Buenos Aires. An

intense drought prevailed at Perth, and both Rio and Cape Town had less than a third of the normal rainfall.

In April pressure conditions referred to the normal were very irregular, the values, to take extremes, being much under the average at Wellington, and considerably in excess at Punta Arenas. The general excess of temperature was 0°·4, the month being the warmest April on record at Sydney, the South Orkneys, South Georgia and Johannesburg, and the coldest on record at Perth. At the other stations comparatively normal conditions prevailed; there was a drought in New South Wales, on the coast of Chile in latitude 40° S., at Santiago, and at Johannesburg. On the other hand the rainfall was excessive in Argentina, where many stations had enormous excesses.* At such widely separated stations as Hobart, Christmas Island, and Evangelists Island there was also an excess with an extreme record at the last named station.

In May pressure was well in excess of the normal in Australia, New Zealand, Brazil and South Africa, and in defect at the South Orkneys and Magellan Straits region. Temperature was low in New Zealand, at Perth, and at Rio, and high in the far South Atlantic, Argentina and South Africa. Rainfall was under half the average at Perth, Adelaide, and Rio; the wettest area being on the Buenos Aires littoral, where nearly double the normal fell.

In the three winter months, June, July, and August, which can be conveniently treated as a whole, pressure was markedly above the average in West and South Australia, and to a less degree in New Zealand, and much below the average in South America, between the parallels of 23° and 40° S. The low pressure at Punta Arenas and the South Orkneys is also worthy of remark. Temperature was very generally above the average, and while neither June nor July were "record" months anywhere, August was notable warm in Australia and cold in the south of Argentina and the South African hinterland. Both Adelaide and Sydney showed August records for warmth, while Johannesburg broke the record for cold. As regards rainfall, the outstanding features were the great droughts at Rio de Janeiro, which had the driest winter in a record beginning in 1851, the excessive precipitation in the middle latitudes of Argentina and Chile, and the scanty rainfall at Adelaide, some parts of New Zealand, and in the region of Magellan Straits. In July all previous records for dry weather were broken at Evangelists Island and Rio, and in August at Adelaide, three New Zealand stations, the South Orkneys and Point Galera.

In September pressure was very high in Australia, New Zealand, and the far South Atlantic, and low in Brazil and the middle latitudes of Argentina. At Melbourne it was the highest in Sep-

* See *Met. Mag.*, Vol. **49**, p. 102.

tember during the 57 years covered by the records, exceeding the normal by 0·25 in. Except for the warmth in West Australia and at Johannesburg, and the cold in the south of South America the temperature values do not call for comment. Rainfall was very large in the middle latitudes of Chile and to a less degree on the littoral of Buenos Aires, and at Sydney. A drought prevailed in South and West Australia, over all but the western points of New Zealand, at Johannesburg, and at Christmas Island, with extreme records at Perth, South Georgia, and Christmas Island.

In October the outstanding feature of the pressure distribution was the great excess over South Australia and New Zealand, and the equally marked defect at the South Orkneys, which had the lowest October mean pressure on record, while Melbourne had the highest. Temperature was very high in South and West Australia where all previous records for heat were broken at Perth, Adelaide, and Melbourne. The month was also warm at Hobart, Dunedin, Cape Town and Christmas Island, and distinctly cold at Hokitika, on the west coast of the South Island of New Zealand, and the South Orkneys. There was a great drought in South Australia; Adelaide having the lowest rainfall in 74 years, and Melbourne in the 69 years of observations, while the 15 years' data from Evangelists Island and Point Galera also show extreme records of deficient rain. On the other hand Santiago had more than five times and Sydney nearly three times the normal.

In November pressure was generally under the average, except at Melbourne. Temperature, except in South Australia and one or two other widely separated localities, was under the normal, the low temperature being specially marked on the west coast of New Zealand and the Patagonian region. Extreme records for warmth were established at Melbourne, Sydney, and Christmas Island, and for cold at Hokitika. Rainfall was generally in excess of the normal, but in the North Island of New Zealand, the Magellan Strait area, and at Christmas Island was about half the normal. On the other hand the rainfall was more than double the average at Perth, Concepcion and Ajo; and at Santiago de Chile as much as ten times the long average. At this station September was the wettest since 1868, October the wettest since 1891, while November's rainfall constituted a "record." It must of course be noted that the *mean* monthly rainfalls at Santiago for the three months under review are relatively small, 1·16 in., ·57 in., and ·21 in., respectively.

In December pressure was rather low over Australia, New Zealand, and the south of Brazil, and high in Magellan Strait. Temperature was in excess of the normal in South Australia, the South Orkneys, St. Helena, and Christmas Island, and below the normal in most other localities; the low temperature on the west coast of New Zealand, where Hokitika was as much as 7°·4 under

the average (a record), being a marked feature. Rainfall was rather irregular, "records" for excess being set up at the South Orkneys and Johannesburg.

During the year 1914 pressure did not vary from the average more than ·04 in. at any station, except Melbourne, where the excess was a tenth, while the mean annual value at Perth (W. Australia), was the highest since 1877. Temperature was the highest on record at Adelaide and Sydney, and was also considerably above the normal at Johannesburg and St. Helena, where every month except April had a mean in excess of the average. The north and west of New Zealand and Magellan Strait had a mean much below the average, Hokitika having a deficiency of 2°·2, the lowest since 1868. The year was the driest in a 74 years' record at Adelaide, and in a 39 years' record at Perth, and the wettest in a 57 years' record at Ajo. The drought was also very pronounced at Auckland, where there were only two years with a smaller rainfall than 1914, viz., 1859 and 1885. During the last five months of the year both Auckland and Wellington had the lowest rainfall yet recorded. In other regions the year was a wet one in Chile, between latitudes 30° and 38° S., at Sydney and St. Helena, while a moderate deficit was noted at Rio de Janeiro, the West Indies, and Christmas Island.

At the May meeting of the Royal Meteorological Society Dr. Mill and Mr. H. E. Carter read a paper on "The Wet Winter in England," and also made reference to previous wet winters, those of 1876-77 and 1911-12. We have examined a considerable mass of data referring to the conditions in the Southern Hemisphere and find that as a rule so far as any rule can be established from three cases, wet winters in England are preceded by hot and dry weather in South Australia and New Zealand, and moderate warmth and rainfall at Cape Town, returns from other places examined being conflicting. The conditions associated with the wet winters under consideration are not very definite, the most pronounced being heat at Sydney and Adelaide, and great cold in New Zealand. Dunedin and Hokitika show a pronounced excess of rainfall and Rio a defect. During the four months, November, 1914, to February, 1915, a great drought prevailed at Auckland, Wellington, and Cape Town, while at Hokitika 63·43 in. of rain fell, being 167 per cent. of the normal and the highest yet observed during this period. The period at Hokitika was also the coldest on record, the mean temperature being 4°·8 under the average, while Sydney, Adelaide, and Perth gave a mean excess of 2°·4. It is worthy of note that in January and February, 1915, no rain fell at Cape Town, while for the first quarter of this year the mean temperature was 72°·1, the heat and drought being unprecedented in the past three quarters of a century.

TABLE IV.—*Showing the Monthly and Annual Rainfall of 1914 as a Percentage of the Average.*

NOTE.—Record Values are shown in heavy type.

Station.	Years taken for Average.	Years of Obsns.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
AUSTRALIA.															
Perth	1876-1913	39	13	267	4	45	38	86	70	42	18	70	227	81	61
Adelaide	1840-1912	74	146	57	103	95	49	21	52	14	31	10	181	62	54
Melbourne	1840-1850, 1855-1912	69	78	9	78	74	118	74	99	36	46	11	107	139	73
Sydney	1840-1912	73	18	36	214	29	64	98	183	65	183	270	88	276	117
TASMANIA.															
Hobart	1841-1879, 1882-1912	72	13	8	76	171	51	15	122	63	47	17	66	139	65
NEW ZEALAND.															
Auckland	1871-1910	56	49	58	76	145	109	76	80	29	40	27	47	70	68
Wellington	1871-1910	47	77	63	65	61	164	78	42	23	36	38	56	62	64
Hokitika	1867-1880, 1894-1914	35	136	83	34	132	96	57	89	67	84	50	191	138	97
Dunedin	1871-1910	47	108	108	54	116	84	85	64	21	55	57	105	109	80
SUB-ANTARCTIC.															
South Orkneys	1904, 1906, 1908-1910, 1912-1914	8	100	124	102	111	90	142	122	64	60	100	66	151	102
South Georgia	1882-1883, 1906-1914	10	116	54	39	133	61	129	142	101	39	—	—	—	—

TABLE IV.—*Showing the Monthly and Annual Rainfall of 1914 as a Percentage of the Average—continued.*

Station.	Years taken for Average.	Years of Obsns.	Jan.	Feb.	March.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
SOUTH AMERICA.															
Punta Arenas	1901-1910	27	74	97	56	110	165	59	(59)	29	70	53	51	175	(85)
Punta Arenas	1888-1910	27	93	90	56	117	155	73	(46)	28	84	58	64	184	(90)
Evangelists Island	1901-1910	15	72	187	115	170	131	66	42	76	94	68	66	113	101
Point Galera	1901-1910	15	251	32	35	34	116	114	114	57	158	51	183	79	98
Valdivia	1901-1910	20	318	14	48	27	141	128	125	67	149	45	187	84	101
Concepcion	1901-1910	35	389	0	62	79	66	113	143	91	189	151	242	90	115
Concepcion	1876-1887 / 1892-1910	35	299	0	64	74	82	149	162	76	200	117	202	68	124
Santiago de Chile	1901-1910	48	0	0	0	66	63	196	115	142	634	543	2298	0	169
Santiago de Chile	1867-1910	48	0	0	0	42	100	252	143	123	347	498	1018	0	192
Ajo (Argentina) ..	1858-1911	57	200	156	179	15	181	187	191	264	152	149	249	119	212
Rio de Janeiro ..	1858-1911	64	51	148	32	193	41	1	5	10	55	126	68	113	82
WEST INDIES.															
Trinidad	1862-1910	53	17	38	66	50	52	89	56	92	106	91	109	117	83
Grenada	1891-1910	24	40	71	92	108	85	77	71	71	83	118	98	72	81
S. ATLANTIC.															
St. Helena	1892-1910	23	118	126	122	129	136	102	94	137	131	72	224	143	125
S. AFRICA.															
Cape Town	1871-1910	73	351	62	30	75	58	91	119	117	132	28	102	48	93
Johannesburg ..	1905-1914	10	50	68	76	35	60	380	0	242	13	82	171	178	97
Kimberley	1894-1913	21	35	64	60	105	178	200	0	300	130	212	162	211	108
Christmas Island ..	1902-1913	13	10	35	117	168	169	195	14	26	5	1	51	143	85

ROYAL METEOROLOGICAL SOCIETY.

An ordinary meeting of this Society was held on June 16th, at 70, Victoria Street, Westminster, Major H. G. Lyons, F.R.S., President, in the Chair.

The President announced that the Council had accepted the resignation of the Assistant Secretary, Mr. William Marriott, who was now retiring after 43 years of valuable work with the Society. The Fellows of the Society could only realize in part their indebtedness at all times to his kindly help, and the science of Meteorology, to the development of which he had devoted himself, owed much to his labours.

Prof. H. H. Turner, D.Sc., F.R.S., read a paper on "Discontinuities in Meteorological Phenomena." This paper formed a continuation of the author's previous researches in periodicity in rainfall incidence. There was apparently a regular series of dates at each of which a new chapter was opened in the history of the weather. The weather during each period had pronounced individual features, and the changes between the periods were abrupt and not gradual. The study of these discontinuities in various long series of observations brought to light a remarkable coincidence between the changes and certain regular laws connected with the movement of the earth's axis. The movement of the earth's pole on its surface was known to be a complex movement which was alternatively large and small. Periods of quiescence in this movement were well marked and appeared to precede the meteorological discontinuities by about a year. Col. H. E. Rawson suggested the possible relation of the 19-month period investigated by Prof. Turner, and the 19-year period noticed in the oscillations of the high pressure belt. The study of the barometer see-saw between the Argentine and Bombay indicated that the anticyclonic belt reached a maximum northerly position at intervals of 19 years, and the dates corresponded roughly to certain of Prof. Turner's critical dates of discontinuities. This pressure oscillation provided a theory for explaining the position of the world's great deserts. Sir Napier Shaw said that Prof. Turner's contribution marked a new stage in the study of periodicity, but the latitude which allowed the mathematician to change the period from time to time gave room for doubt as to the soundness of the theories. Mr. W. W. Bryant said that the theory of the change in the earth's axis provided at least a physical basis to explain meteorological periodicity. As to which was cause and which effect, it had been suggested that the slight deviations noticed in the earth's axis might be due to the changing of the earth's centre of gravity caused by alterations in the positions of the air masses. The best proof of the value of the theory would be found in prediction, a test which had proved an absolute failure in the case of the sunspot forecast.

Messrs. R. Inwards, R. Strachan, W. B. Tripp, J. S. Dines, and F. J. W. Whipple also spoke.

Mr. Charles Harding read a paper on "Battle Weather in Western Europe." The author tabulated the meteorological data collected from Official reports from August, 1914, to April, 1915, and discussed the abnormalities with relation to the western battle area. The greatest rainfall excess was shown to lie in the south-east of England and the north-east of France. It was not suggested that in the recent wet weather the rainy conditions had been generated by gun-firing, but it seemed quite possible that at times, when conditions were favourable to rain, the rains had been augmented or accelerated by the concussion initiated over the battle grounds.

Mr. W. W. Bryant remarked on the non-coincidence of the positions of gun-fire and individual heavy rains, and the danger of such slender evidence as rain falling at a distance. Mr. E. H. S. Bruce said that it was necessary to consider the actual solid matter liberated by the explosions as a nucleus for haze and rain. Messrs. R. Inwards and W. B. Tripp also spoke.

The following were elected Fellow of the Society : Messrs. A. B. Hitchens and S. Tocherny, F.R.A.S.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

UNUSUAL EFFECTS OF LIGHTNING FLASH IN NORTH LONDON.

When in Edmonton yesterday my interest was roused by hearing reports of a supposed thunderbolt, which had fallen in a garden near by, during a severe thunderstorm on the afternoon of June 30th. The report stated that a hole had been formed in the ground and it seemed that the matter was worth further investigation. This I was enabled to carry out by the kindness of the owner of the garden. The actual damage consisted of three shallow holes arranged in a semicircle four feet in diameter, each hole being about four or five inches deep. The gravelly soil had been thrown out in each case in a direction away from the centre of the semi-circle, and was lying in little heaps close to the individual holes. From the bottom of one depression a small tube, like a mole run, extended downwards in a slanting direction towards the centre of the semi-circle. A stick one foot long could be passed down this without reaching the end. There was heavy rain at the time of the occurrence, and a possible explanation seems to be that a lightning flash struck the ground and followed down the tube like hole which there

is reason to think existed previously. This might cause violent boiling of the water below and the explosive pressure may then have blown out the three depressions in the ground. This would account for the soil in each case being blown out away from the centre of the circle. The curious thing is that the heavy rain had completely flooded the garden to a depth of some 6 inches or more, and one would naturally have expected that if a flash had reached the surface of the pond thus formed it would have dissipated itself in the water and not followed one isolated path into the ground below. During the storm a fountain of water some three or four feet high was observed at the spot just after a lightning flash, though it was not, of course, till the water had subsided that the damage done would be seen. J. S. DINES.

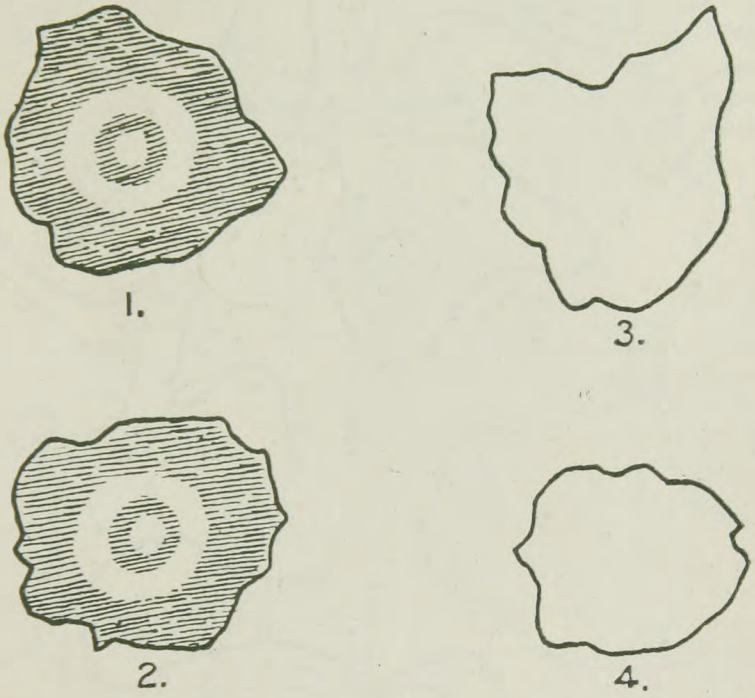
South Farnborough, July 7th, 1915.

THUNDERSTORM AND HAIL, SUNDAY, JULY 4th.

BETWEEN 2.40 and 3.15 p.m. on the afternoon of July 4th we had a thunderstorm accompanied by torrential rain and large hailstones. The lightning was not vivid, nor were there any very loud thunder claps. The thunder consisted of heavy rumblings, almost continuous, for about half an hour. The storm came from W.S.W., and at 3.30 p.m. its lingering traces were declining in the E.N.E., where dark sullen clouds, from which the faintly audible rolling of distant thunder came, were still discernible.

Some of the larger hailstones were $1\frac{1}{4}$ inches in their average dimensions, but they were of many irregular forms. A few were oval, but the shape most favoured was roughly pyramidical. In many specimens the centre of the flat lower side showed a white area fringed with a purer ring of ice and then a white ring. There was, however, little symmetry in the markings or in the shape of the particles. Temperature at the cessation of the storm stood at 61°.

Considerable damage appears to have been done at Bristol and the neighbourhood. Many correspondents describe the hailstones as being as large as walnuts. At Wick and Kingswood several trees were blown down, and 100 panes of glass were smashed in Kingswood Chapel. At Burnham the hailstones are stated to have been of enormous size and many windows were broken. "Gulls caught in the tempest were blown inland as helpless as if they were leaves." Floral displays in the gardens were cut down as if by a sickle. At Mangotsfield the glass suffered materially. Wheat was much damaged and apple trees almost denuded of both foliage and fruit, while in all orchards the crop of apples will be seriously diminished. At Wrington the atmosphere grew so dark

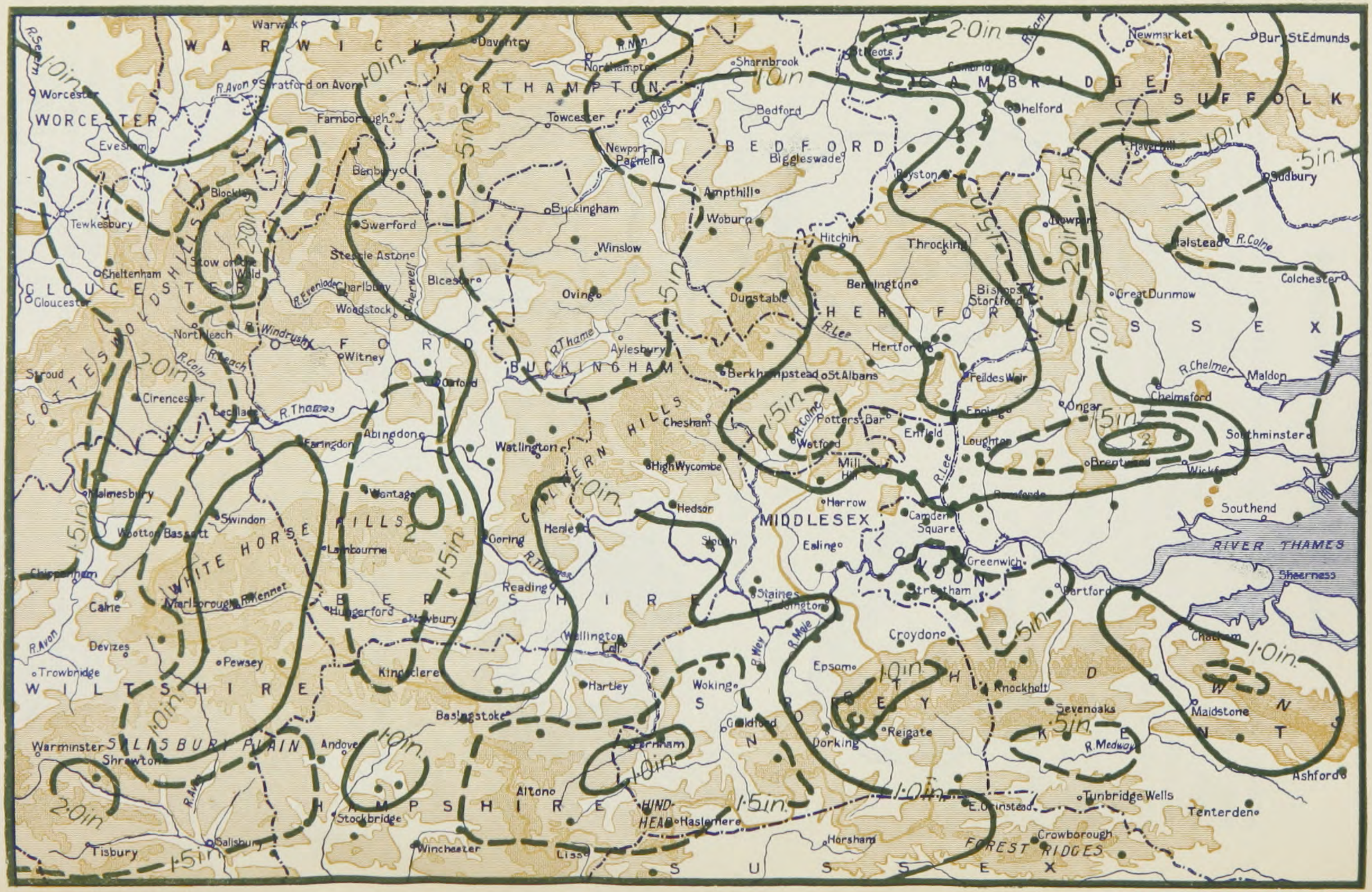


Sections of hailstones which fell at Bristol on July 4th, 1915.

Face p. 98.

W. F. Denning del.

THAMES VALLEY RAINFALL. —— JUNE 1915.



ALTITUDE SCALE

Below 250 feet	250 to 500 feet	500 to 1000 feet	Above 1000 feet

SCALE OF MILES

0 5 10 15 20

Symons's Meteorological Magazine

Watershed of River Thames above Taddington, and River Lee above Feildes Weir

Rainfall Stations reporting

Isohyetals

at 2.30 that one could not see across the road. Broken glass and beaten down crops attested the violence of the storm. At Highbridge, Weston-super-Mare and other towns in this part the same experiences are reported. At Bristol some of the low-lying districts were flooded but not seriously. The fact that the tide was out enabled the fresh to be quickly carried off and thus extensive damage was averted.

It is perhaps worthy of note that on July 1st, 1914, we had a great thunderstorm in this city and serious flooding.

I took tracings of some of the larger particles and here are a few of them in their natural size :—

Nos. 1 and 2 exhibit roughly the markings on the lower flat sides of the stones. No. 4 was about the average size of the stones.

W. F. DENNING.

Bristol, July 4th, 1915.

THUNDERSTORM ON JULY 4th.

DURING a thunderstorm here on July 4th, ·88 in. of rain fell in about half an hour. The storm was accompanied by large hailstones and lumps of ice, one lump I measured was 1½ inches by one inch, and half an inch thick in the centre, and many round hailstones were three-quarters of an inch in diameter. The hailstones had concentric layers of clear and opaque ice, and under a lens appeared full of minute air bubbles.

ROBT. C. SIKES, M.Inst.C.E.

Milton Cottage, Stapleton, Bristol, July 7th, 1915.

THE SEASONS.

I DO not think Mr. Bonacina's case for counting May as summer and August as autumn is quite convincing. The solar difference between the two months in favour of May is not very marked, except as between the end of May and the end of August. The relative frequency of thunder in May and gales in August is, perhaps, only apparent to very perceptive people.

On the other hand the difference of air temperature is noticeably to the advantage of August. If there is an autumnal suggestion about the latter part of August, nights in May are sometimes more than autumnal. At least that would probably be the opinion of those whose flowers or vegetables were cut by frost on May 31st last.

G. WESTON.

The Vicarage, Bethersden, Ashford, Kent.

RAINFALL TABLE FOR JUNE, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·28	·69
Tenterden	*Kent*	51 4	*0 41	190	2·03	·71
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·13	·45
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·17	1·97
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·27	1·49
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	2·14	1·76
Shoeburyness	*Essex*	51 31	*0 48	13	1·77	·79
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·21	1·15
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	1·77	1·90
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	2·18	2·03
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·18	1·49
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·43	·96
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·59	1·05
Boston	*Lincolnshire*	52 58	0 1	11	1·95	·88
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	2·06	·71
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·55	3·58
Macclesfield	*Cheshire*	53 15	2 7	501	2·85	2·33
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	2·26	1·64
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	3·63	·84
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·17	·78
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	2·09	·28
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·04	·48
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	6·94	1·80
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	2·55	1·25
Haverfordwest	*Pembroke*	51 48	4 58	90	2·74	4·12
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	2·97	1·73
Llandudno	*Carnarvon*	53 20	3 50	72	1·97	1·53
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	2·84	...
Marchmont House	*Berwick*	55 44	2 24	498	2·38	1·52
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	3·04	1·00
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	2·41	1·85
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	3·64	2·12
Mull (Quinish)	,,	56 34	6 13	35	3·30	·99
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·06	1·70
Braemar	*Aberdeen*	57 0	3 24	1114	2·18	2·22
Aberdeen (Cranford)	,,	57 8	2 7	120	2·02	1·50
Gordon Castle	*Moray*	57 37	3 5	107	2·13	·71
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	2·07	·68
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	4·07	·79
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·10	·46
Wick	*Caithness*	58 26	3 6	77	1·83	·85
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	2·92	1·97
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	2·79	2·11
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	2·70	1·68
Ennistymon House	*Clare*	52 57	9 18	37	3·18	1·84
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·59	1·48
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·58	2·37
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·00	1·62
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	2·72	2·77
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	3·17	2·17
Cong (The Glebe)	,,	53 33	9 16	112	3·18	1·56
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·11	2·83
Seaforde	*Down*	54 19	5 50	180	2·88	1·46
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	2·56	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	2·82	2·76

RAINFALL TABLE FOR JUNE, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875–1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875–1909. in.	STATION.
—1·59	30	·17	26	8	10·96	13·94	+2·98	127	25·11	Camden Square
—1·32	35	·38	30	6	11·44	14·17	+2·73	124	27·64	Tenterden
—1·68	21	·19	28	7	12·46	16·93	+4·47	136	30·48	Patching
— ·20	91	1·07	30	8	13·31	17·44	+4·13	131	31·87	Cadland
— ·78	66	·53	25	10	10·60	12·66	+2·06	119	24·58	Oxford
— ·38	82	1·39	30	8	11·22	10·16	—1·06	91	25·20	Swanspool
— ·98	45	·31	28	8	8·00	8·74	+ ·74	109	19·28	Shoeburyness
—1·06	52	·46	28	7	10·76	10·82	+ ·06	101	25·40	Westley
+ ·13	107	1·23	28	9	9·61	12·98	+3·37	135	23·73	Geldeston
— ·15	93	·44	28	11	15·88	20·62	+4·74	130	38·27	Polapit Tamar
— ·69	68	·45	27	9	14·33	14·58	+ ·25	102	33·54	Rousdon
—1·47	40	·78	25	7	13·08	13·54	+ ·46	104	29·81	Stroud
—1·54	41	·40	25	7	14·30	17·08	+2·78	119	32·41	Wolstaston
—1·07	45	·31	25	11	9·86	8·90	— ·96	90	23·35	Boston
—1·35	34	·28	28	6	10·80	8·67	—2·13	80	24·46	Hodsock Priory
+1·03	140	2·19	30	7	11·77	12·24	+ ·47	104	26·65	Mickleover
— ·52	82	1·21	25	9	14·76	16·24	+1·48	110	34·73	Macclesfield
— ·62	73	·47	25	8	12·96	14·02	+1·06	108	32·70	Southport
—2·79	23	·35	30	8	27·22	27·07	— ·15	99	61·49	Arncliffe
—1·39	36	·62	30	3	11·63	11·54	— ·09	99	26·87	Ribston Hall
—1·81	13	·15	26	4	11·08	9·98	—1·10	90	26·42	Hull
—1·56	24	·19	26	6	11·55	10·08	—1·47	87	27·94	Newcastle
—5·14	26	·30	29	10	56·38	55·24	—1·14	98	129·48	Seathwaite
—1·30	49	·50	25	12	17·22	16·68	— ·54	97	42·28	Cardiff
+1·38	150	1·27	22	13	19·45	22·67	+3·22	117	46·81	Haverfordwest
—1·24	58	·38	28	9	18·12	22·49	+4·37	124	45·46	Gogerddan
— ·44	78	·53	23	7	12·37	13·63	+1·26	110	30·36	Llandudno
...	...	...	...	...	19·06	...	...	...	43·47	Cargen
— ·86	64	·69	26	8	14·38	11·10	—3·28	77	33·76	Marchmont
—2·04	33	·56	5	5	21·10	23·97	+2·87	113	49·77	Girvan
— ·56	77	1·18	26	6	15·51	13·45	—2·06	87	35·97	Glasgow
—1·52	58	·88	26	9	29·32	31·74	+2·46	108	68·67	Inveraray
—2·31	30	·39	2	10	23·55	24·46	+ ·91	104	56·57	Quinish
— ·36	83	·70	26	7	12·02	11·35	— ·67	94	28·64	Dundee
+ ·04	102	1·13	29	6	15·15	18·37	+3·22	121	34·93	Braemar
— ·52	74	·64	26	10	14·02	13·31	— ·71	95	32·73	Aberdeen
—1·42	33	·30	2	8	12·27	13·08	+ ·81	107	30·34	Gordon Castle
—1·39	33	·19	4	9	20·22	15·26	—4·96	75	44·53	Fort Augustus
—3·28	19	·28	2	7	37·55	35·42	—2·13	94	83·93	Bendamph
—1·64	22	·14	26	8	14·28	....	...	...	31·90	Dunrobin Castle
— ·98	46	...	...	...	12·71	10·17	—2·54	80	29·88	Wick
— ·95	67	..	...	...	24·87	23·64	—1·23	95	54·81	Killarney
— ·68	76	·66	26	12	17·40	15·65	—1·75	90	39·57	Waterford
—1·02	62	·31	26	12	17·51	16·36	—1·15	93	39·43	Castle Lough
—1·34	58	·70	4	10	19·67	19·97	+ ·30	102	46·52	Ennistymon
—1·11	57	·36	25	11	15·42	13·48	—1·94	87	34·99	Courtown Ho.
— ·21	92	·38	10	15	15·84	14·37	—1·47	91	35·92	Abbey Leix
— ·38	81	·54	25	13	12·15	11·12	—1·03	92	27·68	Dublin
+ ·05	102	·58	26	13	16·01	17·65	+1·64	110	36·15	Mullingar.
—1·00	68	·62	4	10	23·38	22·93	— ·45	98	52·87	Enniscoe
—1·62	49	·53	2	9	21·41	19·68	—1·73	92	48·90	Cong
— ·28	91	·65	4	14	18·83	26·72	+1·89	110	42·71	Markree
—1·42	51	·58	4	6	17·42	16·22	+1·20	93	38·91	Seaforde
...	...	...	...	...	15·49	...	...	...	37·56	Dundarave
— ·06	98	·82	4	11	17·10	16·99	— ·11	99	39·38	Omagh

SUPPLEMENTARY RAINFALL, JUNE, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	·96	XI.	Lligwy	·75
,,	Ramsgate	·46	,,	Douglas	·89
,,	Hailsham	·93	XII.	Stoneykirk, Ardwell House...	·96
,,	Totland Bay, Aston House...	·67	,,	Carsphairn Shiel	1·34
,,	Stockbridge, Ashley..	1·42	,,	Beattock, Kinnelhead	1·17
,,	Grayshott	1·51	,,	Langholm, Drove Road	2·56
III.	Harrow Weald, Hill House...	1·19	XIII.	Meggat Water, Cramilt Lodge	1·06
,,	Caversham, Rectory Road ...	1·04	,,	North Berwick Reservoir.....	1·68
,,	Pitsford, Sedgebrook.....	·36	,,	Edinburgh, Royal Observaty.	1·58
,,	Woburn, Milton Bryant.....	·75	XIV.	Maybole, Knockdon Farm ...	1·10
,,	Chatteris, The Priory..... ...	1·21	XV.	Ballachulish House	1·56
IV.	Elsenham, Gaunts End	2·36	,,	Campbeltown, Witchburn ..	1·82
,,	Colchester, Hill Ho., Lexden	·50	,,	Holy Loch, Ardnadam.....	3.09
,,	Ipswich, Rookwood, Copdock	·46	,,	Islay, Eallabus	1·90
,,	Blakeney..... . ..	·62	,,	Tiree, Cornaigmore	1·32
,,	Swaffham	·83	XVI.	Dollar Academy	1·74
V.	Bishops Cannings	1·82	,,	Balquhidder, Stronvar.....	1·76
,,	Wimborne, St. John's Hill ...	·58	,,	Glenlyon, Meggernie Castle..	1·54
,,	Ashburton, Druid House.. ...	1·82	,,	Blair Atholl	2·54
,,	Cullompton	2·00	,,	Coupar Angus	1·27
,,	Lynmouth, Rock House	1·51	,,	Montrose, Sunnyside Asylum.	·69
,,	Okehampton, Oaklands..	1·86	XVII.	Alford, Lynturk Manse	1·07
,,	Hartland Abbey.....	1·65	,,	Fyvie Castle	1·56
,,	Probus, Lamellyn.....	3·89	,,	Keith Station	1·19
,,	North Cadbury Rectory.....	1·27	XVIII.	Rothiemurchus	·93
VI.	Clifton, Pembroke Road.....	·94	,,	Loch Quoich, Loan	1·05
,,	Ross, The Graig	·62	,,	Drumnadrochit	·47
,,	Shifnal, Hatton Grange.....	1·59	,,	Skye, Dunvegan	·74
,,	Droitwich.....	·84	,,	Lochmaddy, Bayhead	·59
,,	Blockley, Upton Wold.....	2·24	,,	Glencarron Lodge	·91
VII.	Market Overton.....	2·24	XIX.	Invershin	·48
,,	Market Rasen	·33	,,	Melvich	·53
,,	Bawtry, Hesley Hall	·58	,,	Loch Stack, Achfary	·69
,,	Derby, Midland Railway.....	1·24	XX.	Dunmanway, The Rectory ..	3·55
,,	Buxton	...	,,	Glanmire, Lota Lodge.....	2·11
VIII.	Nantwich, Dorfold Hall	1·43	,,	Mitchelstown Castle	2·54
,,	Chatburn, Middlewood	1·07	,,	Darrynane Abbey.....	2·93
,,	Lancaster, Strathspey	·87	,,	Clonmel, Bruce Villa	1·55
IX.	Langsett Moor, Up. Midhope	1·35	,,	Newmarket-on-Fergus, Fenloe	1·14
,,	Scarborough, Scalby	·41	XXI.	Laragh, Glendalough	2·03
,,	Ingleby Greenhow	·64	,,	Ballycumber, Moorock Lodge	2·26
,,	Mickleton	·40	,,	Balbriggan, Ardgillan	1·44
X.	Bellingham, High Green Manor	·91	XXII.	Ballynahinch Castle.....	...
,,	Ilderton, Lilburn Cottage ...	·92	,,	Woodlawn	2·06
,,	Keswick, The Bank.....	1·41	,,	Westport, St. Helens	1·79
XI.	Llanfrechfa Grange	1·02	,,	Dugort, Slievemore Hotel ...	2·63
,,	Treherbert, Tyn-y-waun	3·58	,,	Mohill Rectory	2·33
,,	Carmarthen, The Friary	2·38	XXIII.	Enniskillen, Portora.....	2·59
,,	Fishguard Goodwick Station.	4·22	,,	Dartrey [Cootehill]	2·75
,,	Crickhowell, Tal-y-maes.....	1·10	,,	Warrenpoint, Manor House ..	1·80
,,	New Radnor, Ednol	2·12	,,	Banbridge, Milltown	2·55
,,	Birmingham WW., Tyrmynydd	2·02	,,	Belfast, Cave Hill Road	1·65
,,	Lake Vyrnwy	1·20	,,	Ballymena Harryville	2·46
,,	Llangynhafal, Plâs Draw.....	·88	,,	Londonderry, Creggan Res...	3·79
,,	Dolgelly, Bryntirion.....	1·84	,,	Dunfanaghy, Horn Head ...	1·13
,,	Bettws-y-Coed, Tyn-y-bryn...	...	,,	Killybegs	1·61

THE WEATHER OF JUNE.

THE month opened with relatively high pressure over the Iberian Peninsula and low pressure off the north of Scotland, showers being experienced in some parts of Ireland and Scotland. On the 2nd the Atlantic depression spread farther over the United Kingdom, the southerly current bringing heavy rain in the south of Ireland, the maximum amounts being 1·36 in. at Caheragh, 1·30 in. at Valentia, and 1·07 in. at Darynane, sharp ground frosts were noted on the morning of the 2nd in such widely separated localities as the north of Scotland, North Wales, and in Devonshire. On the 4th and 5th temperature rose considerably reaching a maximum for the month in most localities on the 8th, the highest values recorded being 90° at Cromer and Norwich, and 89° at several other places in the east of England and at Camden Square. The highest temperatures in most parts of Ireland and Scotland were recorded on the 12th. Associated with the high temperature small shallow depresssions producing a thundery type of weather developed on the 7th and 8th. On the 9th an inch fell at Skegness, and on the following day during a heavy thunderstorm at Llanuddansant, Carmarthen, as much as 3·03 in. fell in rather less than three hours. From about the 12th to the 23rd anti-cyclonic rainless conditions associated with easterly winds and much sunshine prevailed over the whole country and ground frosts occurred in many parts. On the 18th and 19th even shade minima as low as 28° were recorded at Balmoral, 31° at Durham, and 32° or slightly less in the midland counties and the north-west of England. During this cold period which did great damage to crops and vegetables the shade temperature at Margate at no time fell below 50°, and at Ventnor 48°. A sharp ground frost was also noted on the morning of the 20th, the thermometer falling to 24° at Llangammarch Wells, 25° at Greenwich, and 26° at Tunbridge Wells and Birmingham, while in the shade the temperature fell to 32° at the first named station and also at Balmoral. Frost also occurred in the middle and west of Ireland damaging the potato crop. Between the 22nd and the 25th a cyclonic disturbance in the south ended the long dry period, rain falling locally with heavy thunderstorms during the last four days of the month. At Wernbystack and Llanfrechfa Grange, in South Wales, an absolute drought of 36 days terminated on the 24th. Partial droughts lasting about six weeks occurred at Liverpool, 44 days, Mansfield 42 days, and Totland Bay 41 days. Several heavy rainfalls occurred during the thunderstorm, at the close of the month the maximum daily falls reported being 2·80 ins. at Buxton and 2·19 ins. at Mickleover on the 30th. The scanty rainfall of the month was very irregular in distribution. More than three inches fell in the extreme south of Ireland, over the greater part of Cornwall and in several small areas in Wales, the north of Ireland, and the Midlands. Less than an inch fell over the east coast districts and in a narrow fringe on the south coast, while the north of Scotland was equally dry, less than a third of the average falling in many places. At Hull only 13 per cent. of the normal fell, and at Bendamph where no rain fell after the 8th, 19 per cent. In Ireland more than half the average fell practically everywhere.

In the Thames Valley most rain fell on the Cotteswolds, where there was over two inches, while in parts of Buckingham and North Hants less than one-fourth of an inch fell. Over the Kingdom as a whole, the general rainfall expressed as a percentage of the average was as follows :—England and Wales, 57 ; Scotland, 49 ; Ireland, 73 ; British Isles, 59.

Sunshine was abundant, the following amounts being reported :—Camden Square, 206·2 hours ; Totland Bay, 215·3 hours ; Copdock, 241·2 hours ; Sidmouth, 205·4 hours ; Ashbourne, 226·8 hours ; Matlock Bath, 224·1 hours ; Southport, 243·9 hours ; Hull, 150·0 hours ; Haverfordwest, 199·7 hours ; Paisley 204·0 hours ; Lock Stack, 248·0 hours ; Swinton, 165·1 hours.

In London (Camden Square) a partial drought lasting 39 days ended on the 25th. Mean temperature 61°·1 or 1° above the average. Duration of rain 8·8 hours. Evaporation 3·15 inches.

Climatological Table for the British Empire, January, 1915.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	53·3	13	26·7	23	44·1	35·6	35·8	86	73·3	24·0	4·12	19	7·9
Malta	68·9	29	45·5	21	60·1	50·9	...	86	142·0	...	1·79	11	1·8
Lagos	90·3	23	67·0	10	87·5	74·3	71·0	73	139·5	62·0	·78	4	6·6
Cape Town	94·8	8	59·5	3	82·6	63·7	59·2	62	...	...	·00	0	2·4
Natal, Durban ...	..	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	84·8	2	53·9	17	75·3	58·1	60·2	88	..	52·4	11·63	19	7·4
Mauritius	91·5	28	68·2	5	87·5	71·9	67·2	68	...	60·4	1·03	14	5·8
Bloemfontein	93·7	11	58·4	6	85·3	64·0	58·5	61	..	...	4·37	10	4·7
Calcutta...	85·8	27	49·3	2	78·5	57·3	54·8	65	...	38·6	·41	2	3·7
Bombay...	87·2	12	62·3	9	83·4	68·5	62·7	66	134·0	49·4	·00	0	1·7
Madras	86·7	11	65·9	9, 28	84·1	69·9	68·8	80	153·2	62·5	9·61	8	5·2
Colombo, Ceylon ...	91·0	24	66·3	30	86·8	72·3	71·7	78	162·6	62·1	1·49	14	4·5
Hongkong	71·0	28	41·7	16	64·0	56·3	51·8	72	...	...	·35	6	5·4
Sydney	104·6	26	57·4	9	80·1	64·7	59·2	65	164·3	48·2	1·18	8	4·7
Melbourne	103·7	16	48·6	22	77·9	57·4	51·5	55	160·3	40·6	1·61	8	4·5
Adelaide	108·3	16	50·2	8	87·1	61·3	50·0	38	159·3	41·1	·49	3	3·3
Perth	102·2	11	56·6	19	87·5	66·2	62·5	66	170·0	48·6	·87	3	2·6
Coolgardie	103·4	23	53·2	20	86·5	63·5	55·1	50	160·0	52·0	3·43	9	4·3
Hobart, Tasmania ..	92·9	25	47·2	14	70·1	52·8	45·8	55	151·1	37·6	·17	9	6·6
Wellington ...	84·0	29	47·6	2	69·0	57·1	54·7	74	152·0	33·4	1·73	8	6·5
Auckland	81·5	9	50·0	20	72·6	59·2	57·7	76	152·0	47·0	3·09	6	5·6
Jamaica, Kingston ..	89·9	29	66·8	25	86·2	70·3	67·8	75	...	...	1·11	6	..
Grenada	86·0	24	71·0	3	82·8	72·7	...	76	135·0	...	5·06	9	2·8
Toronto	46·7	17	-1·0	22	30·7	16·6	18·7	88	110·0	-6·0	3·53	12	6·6
Fredericton	51·0	19	-29·0	31	28·0	8·9	...	85	...	...	3·34	9	6·0
St. John, N.B. ...	50·0	7	-9·0	31	32·0	16·7	22·2	78	...	...	5·79	9	5·6
Alberta, Edmonton ...	43·3	17	-22·0	27	19·9	1·9	...	89	82·8	-27·8	·55	8	5·6
Victoria, B.C.	49·4	30, 31	30·9	22	44·3	36·7	37·0	87	...	...	1·55	14	6·6

Johannesburg.—Bright sunshine 166·2 hours.

Mauritius.—Mean temp. 0°·5 above, dew point 3°·1 below, and R 6·58 in. below, averages. Mean hourly velocity of wind 10·1 miles, or 1·0 miles below average.

COLOMBO, CEYLON.—Mean temp. 79°·6 or 0°·6 above, dew point 1°·5 above, and R 1·79 in. below, averages. Mean hourly velocity of wind 6·4 miles.

HONGKONG.—Mean temp. 60°·1. Mean hourly velocity of wind 10·9 miles. Bright sunshine 179·4 hours.

Melbourne.—Mean temp. 0°·2 above, and R ·21 in. below, averages.

Adelaide.—Mean temp. 0°·1 above, and R ·24 in. below, averages.

Perth.—Mean temp. 3°·2 above average, excessive rains recorded.

Coolgardie.—Temp. 2°·6 above, and R about 3 in. above, averages.

Hobart.—Mean temp. 0°·9 below average.

Wellington.—Mean temp. 0°·6 above, and R 1·58 in. below, averages. Bright sunshine 232·7 hours.

Auckland.—Rainfall slightly above, temperature slightly below, and sunshine below, averages.

ALBERTA, EDMONTON.—Warm and sunny with large variations of temperature, less snow than usual.

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Professor Andrew John Herbertson.

1865-1915.

Andrew John Herbertson, who died after some month's illness, on July 30th, was born at Galashiels, and studied at the University of Edinburgh, Montpellier, and Freiburg, taking the degree of Doctor of Philosophy in Geography at the last named. He held successively the position of Lecturer on Geography at the Heriot Watt College, Edinburgh, and at Owens College, Manchester, and Reader in Geography at the University of Oxford, and received the title of University Professor of Geography in 1910. He was a member of Wadham College and an honorary M.A. of the University.

Professor Herbertson devoted himself to the educational aspects of geography with great enthusiasm and success and did much to build up the Oxford School of Geography and to improve the teaching of the subject by the teachers he trained and the numerous admirable text-books which he wrote. In his literary work he was fortunate in having the collaboration of his wife, herself a geographical writer of no small distinction. While it is on his achievements in geographical education that the reputation of Professor Herbertson must mainly rest, we are more concerned in this place with the valuable contributions he made to the science of climatology. During his student life at Edinburgh he had occasion to take part in the work of the Ben Nevis Observatory and so came under the inspiring influence of the late Dr. A. Buchan. He joined Dr. J. G. Bartholomew in the editorship of the great *Atlas of Meteorology*, published in 1899, and devoted much time to the preparation of monthly average rainfall maps of all the continents. This work was published by the Royal Geographical Society in 1900, under the title of "The Distribution of Rainfall over the Land."

Professor Herbertson was a member of the Royal Commission on Canals and Inland Navigation during the years 1906 to 1910, and in 1910 he was president of Section E of the British Association. His kindly disposition and charm of manner made him many friends and endeared him to the students of the School of Geography to whom his death will be a heavy loss. We have

enjoyed the friendship of Professor Herbertson for nearly thirty years and have worked together with him at many times and on many subjects, so that we can speak as warmly of his qualities as a man as of his distinction as a geographer.

AN ANTARCTIC BAROMETRIC SEE-SAW.

At a meeting of the Royal Society of Edinburgh, held on June 28th, a paper by Mr. R. C. Mossman on "A Barometric See-Saw between the Weddell Sea and the Ross Sea," was read. The phenomena described were analagous to the see-saws of pressure observed between such pairs of stations as Stykkisholm in Iceland, and Ponta Delgada in the Azores, or between Bombay and Cordoba. The localities under discussion were McMurdo Sound, where Captain Scott's two expeditions furnished four years' complete observations. and Laurie Island, South Orkneys. During 1902 there were no data available from the South Orkneys, but values were interpolated from the isobaric charts for the Weddell Sea area, prepared in connection with the International Antarctic scheme of observation, 1902 to 1904. The data were discussed in three monthly groups, corresponding to the seasons of the year in more temperate regions, with the result that the synchronous pressure departures from the normal were of opposite sign in the two regions. Conditions on the great Antarctic plateau were doubtless the controlling factor. A strong negative correlation between barometric pressure in New Zealand and the Magellan Straits region on the one hand, and that of McMurdo Sound on the other, was also prevalent at all seasons of the year, the pressure relations being similar to those between Australia and McMurdo Sound, to which Dr. Simpson had previously drawn attention. The velocity of the wind was in harmony with the barometric variations, since only in the winter of 1911 and the spring of 1903 were the departures from the normal represented by the same sign in the Weddell Sea and the Ross Sea. That is to say, when it was stormy in the one area light winds prevailed in the other region, and *vice versa*.

As regards air temperature it was shown that in five summers (Shackleton's data for 1908-9 adding another year to the period available for discussion), the departures from the normal in the Ross Sea were the same as those at the South Orkneys, Patagonia, New Zealand and Perth, W.A., and the reverse of those at Sydney and St. Helena. In autumn as in summer the temperature variations in New Zealand and New South Wales were strongly influenced by Antarctic conditions. In spring there was no exception to the rule that cold weather in McMurdo Sound was associated with warm weather at Hobart, Adelaide, Punta Arenas and Rio de Janeiro, while at this season when the temperature at McMurdo Sound was in excess of the normal, there was a deficiency at the

above named places. It was found that when the temperature in summer at McMurdo Sound was below the normal, warm autumns followed at Adelaide, Perth, W.A., St. Helena and Southern Brazil, while warm summers in the Ross Sea area were succeeded by cool autumns in the regions specified. As the wind velocity curve at the South Orkneys smoothed in 3-year groups had steadily fallen since 1905, while the air temperature at St. Helena had risen in sympathy with this diminished air movement, there was probably an intimate inter-relation between the Trade Winds of the South Atlantic and the Antarctic circulation.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE LIMITS OF THE SEASONS.

With regard to the length of the seasons I am quite aware that in my letter in your April number my argument represented mainly the question of temperature, which is the dominant question in the matter. Other questions have not the same relation. That is to say temperature and its daily changes appeal to us more than any other meteorological element, and also to animal life. Thus October to March is in our country the period of wind and storms, and April to September the period of moderate wind. Again, rain is least in our spring and greatest in our autumn. Thunderstorms occur mainly between May and August, although occasionally we get a thunderstorm in winter. These and other matters do not affect us to the same degree as temperature. We must not argue too much on accidental phenomena. We all know that temperatures above 80° can be found in May and above 90° in September, but we cannot call either of these months summer. Again in summer we may have maximum temperatures not much higher than what is sometimes reached in winter. Seasons can only be defined by what is the general state of things. If seasons are to be arranged in a new fashion we shall have different periods in comparatively small geographical areas, thus creating greater difficulty in making comparison between them. Any long established system, if not exactly perfect, should not be hastily given up. For instance, the Centigrade thermometer has made slow progress in our country as people cannot readily realize what temperature 20° or 30° means. Again attempts have been made to revise our calendar by giving the months an equal number of days, but without much success, as it would disturb so much the relation of many events with special days in a manner that would be inconvenient and disagreeable.

WILLIAM ELLIS.

June 23rd, 1915.

HAS not a sufficiently conclusive answer been given to the season question in the June number of this Magazine, wherein Mr. Bonacina's rhapsody over a summer evening in May is immediately followed by the Rev. R. P. Dansey's account of a mid-May snow storm? Mr. Bonacina will no doubt contend that a mid-May snow storm is unusual, but he must admit that snow in mid-August is unknown. I happened also to be in the west of England at the end of May and I was chiefly struck, while passing through the Somerset Marshes, by the acres of black and frost bitten potatoes which I saw, the result of a winter morning in May. My own experience of the west of England, of which I am a native, is that summer seldom asserts itself before mid-summer, or winter before Christmas, and that the early spring is the most disagreeable part of the year. During the 25 years we have kept a record, a frost has been registered as late as May 28th, but none before the second week of October.

Mr. Bonacina loses sight of the fact that the Atlantic Ocean has as much or more influence on our climate than the actual altitude of the sun. It takes till September for this great volume of water to attain its maximum, and till March its minimum, temperature; with the result that our seasons are retarded by some weeks. Mr. Bonacina's theory is no doubt correct for the interior of continents, but it does not apply to regions under the influence of great oceans, like the British Isles, and in fact the whole western fringe of Europe.

A. C. F. LUTTRELL.

July 28th, 1915.

LIGHTNING HOLES.

MR. J. S. DINES, in your July number (p. 97), thinks that the tube like hole, which he found where the lightning had struck, existed previously. I venture to doubt this from my experience of the *two* similar holes, each at the foot of a groove on different sides of a tree, which I found at Charlton Kings in 1898, as described in your Magazine, Vol. **33**, p. 136.

JAMES G. WOOD.

115, Sutherland Avenue, London, W., July 16th, 1915.

[In confirmation of Mr. Wood's contention we may refer to the well known phenomenon of the formation of fulgarites by lightning in sand, and for the formation of such holes in ordinary soil to a paper by the Rev. C. F. Box on "Effects of a Lightning Stroke at Earl's Fee, Bowers Gifford, Essex, April 13th, 1904," read to the Royal Meteorological Society in June, 1904, and summarized in this Magazine, Vol. **39**, p. 114).—Ed., *S.M.M.*].

AUDIBILITY OF DISTANT THUNDER.

On the evening of August 1st, as it was growing dark, between 9 and 9.15 p.m., I was watching a bank of thunder clouds to the west and north-west which rose in towering masses to about 30° from the horizon. They were lighted up at rather long intervals by bright flashes of lightning, the sky elsewhere being almost cloudless. As there was sufficient time between the flashes to avoid any fear of confusion, I determined to note carefully the time-interval between the lightning and its accompanying thunder. A flash at about 9.5 in the W.N.W. was followed by distinctly audible thunder in 115 seconds, and another shortly afterwards in 112 seconds. Taking the velocity of sound at 1121 feet per second (the temperature here at the time was about 59°F.), the distance of the first flash works out at 24·41 miles, and of the second at 23·77 miles. This would indicate that the lightning occurred over the sea about seven miles S.S.W. of Barrow. As the land is almost level from my point of observation (100 ft. above sea-level) to the sea coast near Fleetwood, in the direction of the storm, there was little or nothing to interfere with the transmission of the sound.

The above observation shows that the distance at which thunder can be heard under favourable conditions is much greater than that generally stated in text-books. HOWARD WILSON.

Garstang, August 3rd, 1915.

THUNDERSTORM AND HAIL ON JULY 4th.

In my note on this event published in your journal for July I might have mentioned that the rainfall during the half an hour's storm amounted to 1·07 in. at Clifton. In the morning ·48 in. fell during a heavy downpour between 4 and 5 a.m. Mr. William Garnett at Blackwell Hill House, near Bristol, registered ·82 in. between 2.30 and 2·55 p.m. With regard to the dimensions of the hail stones, several reliable Observers give striking descriptions. At Shipham the larger ones were 5½ inches round. At Winscombe and Axbridge in Somerset they were as large as hen's eggs. At Ilfracombe Mr. C. Wills was shown four lumps of ice which weighed a pound, and on the day after the storm he saw in one yard a barrowful of ice which had survived the hot weather. At Combe Martin large green houses were almost entirely destroyed and trees stripped of their fruit. Along the Chew Valley, a few miles south of Bristol, and at many other places in the track of the storm, it raged with disastrous effect. W. F. DENNING.

Bristol, July 19th, 1915.

THUNDERSTORM RAIN.

During the last few weeks thunder storms have been very frequent in Scotland; one of them occurred at The Trossachs on the afternoon of the 26th July, accompanied by very heavy rain. At 2 p.m. thunder was heard in the distance in an east-south-easterly direction and by 3 o'clock was directly overhead, and the thunder very loud. At that hour the rain commenced and soon became so very heavy that I thought it looked like making a record rate of fall. As there was no rain-gauge in the place I hunted for something suitable to take its place, and succeeded in getting a cylindrical metal vessel $4\frac{1}{4}$ inches in diameter, as it had a thin lip it suited the purpose very well By the time I had got the gauge out it was 3.20 p.m. At 3.23 the rain became lighter, so the gauge was taken in, when it was found that $\frac{1}{4}$ inch of rain had fallen in the three minutes. Though it continued raining the gauge was not then put out, as it was just ordinary heavy rain. At 3.30, however, it again began to come down very heavily and the gauge was again put out and left till 3·59, when the rain somewhat suddenly ceased. During these 29 minutes $1\frac{1}{2}$ inches of rain fell, or at the rate of fully ·10 in. per two minutes. The rainfall for the hour the storm lasted would be considerably over 2 inches, as in addition to the $1\frac{3}{4}$ inches measured there was a very heavy fall for some time before the gauge was put out, and some also fell during the seven minutes while the gauge was not exposed. There was a good deal of hail mixed with the rain, but nothing remarkable about the size or structure of the stones. The storm was very local. Little rain fell one mile to the east or three miles to the W.N.W., the direction to which the storm passed. By 4.30 the sun was shining brightly.

JOHN AITKEN.

Ardenlea, Falkirk, 4th July, 1915.

AFFORESTATION AND THE FLOW OF SPRINGS.

For the purpose of an enquiry before a Parliamentary Committee relating to a Public Water Supply I have recently had occasion to make an examination of certain springs in the County of Northumberland. These springs, of which there are a considerable number, break out along the hillside over a distance of rather more than half a mile at Tosson, near Rothbury. They are shown very clearly on the first edition of the 6-inch Ordnance Map, the survey for which was made in 1863. Of the whole number shown only the three most westerly springs are marked "Springs" on this plan, and it may therefore be presumed that they were particularly well defined when the survey was made. These three springs are not so marked on the 2nd edition of the 6-inch Ordnance Survery, which was revised in 1896, and have now nearly ceased to

flow. What is the reason of this? I believe it to be explained by the fact that a large plantation which did not exist when the first survey was made in 1863, has since been established on the hillside just above them. The plantation does not extend sufficiently to the eastward to affect the flow of the remainder of the springs. As this cause of the depletion of springs has not previously come under my notice, I think the suggestion I make may be of interest to your readers, some of who may possibly be able to throw light upon the matter from personal experience. It can be readily understood that the growth of trees may reduce the flow of springs in two ways: firstly, by absorbing water from the ground, and secondly, by reason of the rainfall being arrested on their foliage and thence evaporated. This subject is one of considerable importance, because if I am right in thinking that the depletion of the springs is due to the plantation, there is an element of insecurity in water supplies so derived and also in those obtained by means of impounding reservoirs, unless in all cases the gathering grounds are under the control of the Water Authorities interested.

W. VAUX GRAHAM.

5, Queen Anne's Gate, Westminster, London, S.W., July 15th, 1915.

[The great interest of this subject leads us to hope that some of our readers may be able to give an account of the springs in question extending over the period since the plantation grew up.—Ed., *S.M.M.*]

PREDICTION BY THE SUNSPOT CYCLE.

In your July issue (p. 96), Mr. Bryant is reported as saying of a theory, that the best proof of its value would be found in prediction, "a test," he adds, "which had proved an absolute failure in the case of the sunspot forecast." I would offer proof that it is possible, in certain cases, with the aid of the sunspot cycle, to forecast a Rothesay summer with reasonable confidence.

Rothesay, it is known, has a valuable record of rainfall going back to 1800, since which date there have been ten sunspot minima. The average summer rainfall is about 11·8 in., and the figures range from 3·9 in. up to 19·1 in. Now we might, I think, formulate two rules, as follows:—

Rule I.—Of the three summers min. 1, 2 (*i.e.*, minimum sunspot year and the two following), expect at least two to have less than 12 in. This has occurred in nine cases out of the ten. In the tenth case (1856 min.), with only one summer under 12 in., the average of the three is under 12 in. I need not enlarge on how this rule would operate. It would not tell us much about the first of the three; but if that had more than 12 in. the two others

might be counted on to have less, and so on. 1913 is the last minimum; that summer and 1914 had both less than 12 in.; thus the character of the present summer would be obscure.

Rule II.—Of the three summers 5, 6, and 7 after min., expect at least two to have more than 12 in. This has occurred in eight cases out of the nine available. The exceptional case is after the 1878 min. To those two rules I would add two relating to the Rothesay year.

Rule III.—In a min. year expect not *more* than six wet months.

Rule IV.—In the fifth year after a min. expect not *less* than six wet months.

The above rules do not cover a great deal of the ground; but they are, I consider, valid as far as they go, and might prove useful on occasion.

ALEX. B. MacDOWELL.

21, Crichton Road, Rothesay, 2nd August, 1915.

THE STORM CLOUDS OF JUNE 30th, 1915.

Unlike June, 1914, which, besides being a magnificent month of intense sun-heat, was characterized almost throughout by terrific thunderstorms, with an exceptional number of lightning fatalities, up and down the country, the June of 1915 was not so remarkable for great storms even during the spell of severe heat which prevailed from the 4th to 9th. But when at last the long parching and often unusually chilly drought broke about the 26th, destructive thunderstorms occurred daily in different parts of the country. The mid-day storm on the 30th which appears to have concentrated its masses of hail over the Essex suburbs, was evinced in Kensington Gardens, where I happened to be at the time, by the blackest and most massive of storms-sheets in the north-east sky, depicting in no mild colours the grand and terrible nature of that species of atmospheric commotion which we see in summer thunderstorms, especially those of the slow-moving stagnant type—which may lock up a valley or clasp a hill range to their inky bosom for hours together. To watch that gigantic thunder pile in London that day, with its black desolate flanks, its tremendous precipices, its gloomy caverns, its lofty snow peaks, now radiant crystal, now hidden by flying scud, was in effect—save only in respect of mutability—to behold the sublimity of the high mountains. We must remember, too, that the white peaks and summits of cumuloform clouds must be from the height at which they are condensed at the top of powerful convection currents, actually composed of snow particles, a fact which renders the analogy between cumulus ranges and mountain ranges the more fascinating.

L. C. W. BONACINA.

Hampstead, N.W., July 5th, 1915.

INTERNATIONAL BALLOON ASCENTS.

By W. H. Dines, F.R.S.

April 11th, 1912.

Starting Point.	Country.	A (Hc) miles	B (Tc) ° F.	C miles.	D ° F.	E miles.	F
Manchester	England ..	6·6	—69	14·1	—60	155	S.E.
Brussels	Belgium ..	7·0	—73	10·1	—64	100	S.E.
Paris.....	France....	7·2	—89	7·6	—85	116	S.E.
Strassburg	Germany..	5·9	—60	6·2	—60	90	S.E.
Munich	„ ..	6·1	—62	9·1	—63	95	S.E.
Vienna.....	Austria ..	4·9	—51	8·6	—53	66	E.S.E.
Pavia	Italy.....	7·3	—80	17·0	?	93	S.S.E.

April 12th, 1912.

Manchester.....	England ..	6·9	—76	7·1	—73	63	S.S.E.
Brussels	Belgium ..	6·5	—78	14·3	—58?	128	S.E.
Hamburg.....	Germany..	4·3	—49	11·0	—49	70	S.S.E.
Lindenburg	„ ..	4·3	—55	7·6	—47	36	E. by S.
Strassburg	„ ..	6·5	—71	7·2	—70	107	S.E.
Munich	„ ..	6·1	—61	6·7	—59	94	E.S.E.
Vienna.....	Austria....	6·1	—54	11·2	—58	101	S. by E.
Pavia	Italy	6·9	—80	9·5	—67	89	E.S.E.
Nizhni Olchedaeff	Russia	3·9	—43	7·1	—46	36	E.N.E.
Batavia	E. Indies ..	10·4	—116	10·9	?	13	W.

April 13th, 1912,

Manchester.....	England ..	6·5	—72	8·9	—62	43	S.
Pyrton Hill	„ ..	6·3	—75	8·1	—62	25	S.S.E.
Brussels	Belgium ..	7·1	—76	16·9	?	58	S.S.E.
Hamburg	Germany..	5·9	—81	7·1	—68	74	S. by E.
Lindenberg	„ ..	4·9	—65	9·5	—62	83	S. by E.
Paris	France....	6·3	—62	10·6	—62	53	S.S.E.
Munich	Germany..	6·3	—74	8·6	—63	75	S.S.E.
Vienna.....	Austria ..	4·9	—58	7·1	—58	80	S.E.
Pavia	Italy	8·3	—80	?	?	47	S.E.
Pavlowsk.....	Russia	5·0	—56	7·6	—54	93	N.N.W.

A Height in miles of commencement of isothermal column.
B Temperature, F°., at bottom of column.
C Greatest height of reliable record in miles.
D Temperature, F°., at greatest height.
E Distance in miles of point where balloon fell
F Bearing of falling point from starting point

The distribution of pressure was somewhat unusual, there being a very considerable decrease of pressure from west to east. On the 12th the difference reached one inch.

Some of the values of Hc are very low, since it is not often that they are less than five miles. The temperature over Batavia, —116F. is again noticeable. It is a very remarkable fact that the lowest temperatures that occur naturally should be found near the equator.

REVIEW.

The Weather and Climate of Chicago. By HENRY J. COX and JOHN H. ARMINGTON. Chicago, 1914. Size $9\frac{1}{2} \times 7$. Pp. 25+375, and plates.

THIS work forms Bulletin No. 4 of the Geographic Society of Chicago, the greater part of the expense of production having been defrayed by several private individuals and companies. The climatic features of the locality, based on official records since 1870, supplemented by some earlier data, have been discussed by the authors in a very exhaustive and clear manner. The work is divided into seven parts, dealing respectively with temperature, precipitation, atmospheric moisture, cloudiness and sunshine, wind direction and velocity, barometric pressure, and storm tracks. The discussion deals first with annual, seasonal, and monthly values, followed by a synopsis of the daily conditions. The data given in the numerous tables are graphically shown in 9 plates and 99 figures, which add greatly to the clearness and interest of the text. More than one-third of the work is devoted to "temperature," and it is pointed out that owing to the proximity of Lake Michigan "the city often enjoys delightful and refreshing breezes while the interior of the country away from the lake is sweltering in an air hot and still almost to the point of suffocation." An interesting example of "lake influence" on temperature is shown in Fig. 26, which gives the thermograph trace for July 21st, 1901, the hottest day on record, with a shade maximum of 103°. Until 2 p.m. a land breeze from the south-west prevailed, when a north-east breeze from the lake set in, bringing the temperature down 18° in the space of a single hour. At 3.25 a land breeze was again ascerting itself, and by 6 p.m. the temperature had risen to 103°. Rapid temperature changes are common especially in winter, thus on November 11th and 12th, 1911, a fall of 60° from 74° to 14° occurred in 18 hours, and on February 8th, 1900, between 8 a.m. and midnight, the temperature fell 52°. The mean annual temperature from 1830 to 1910 is 47°·7, the extremes being 53°·0 in 1846, and 42°·6 in 1864. The warmest month was July, 1868, and the coldest January, 1857, with means of 80°·6 and 10°·7 respectively. The absolute minimum was —24° on December 24th, 1872, showing an extreme temperature range of 127°. The monthly mean temperatures range from 24°·0 in January to 71°·9 in July. Fig. 4 shows the average maximum, minimum, and mean temperature for each day in the year, based on the official records from 1872 to 1910. The cold period in May comes out very clearly, and the retardation of the winter fall during the first half of December is also well shown, the mean temperature on December 14th being only a tenth of a degree lower than on November. 29th. The records of precipitation which begin in 1843, suffer owing to several changes in the height and position of the

gauge. The mean annual fall is 33·99 ins., that of 1858, the wettest year, 47·10 in., and of 1867, the driest, 22·41 in. The wettest month was August, 1885, with 11·28 in., and the driest February, 1877, with ·06 in. Rain falls on the average on 125 days annually. The longest period on which a "trace" or more of rain was recorded is 18 days, and the longest absolute drought 21 days, in February, 1877. The record short period rain was 2·13 in. in an hour, and the heaviest daily rainfall 6·19 in. on August 2nd-3rd, 1885. An interesting map (Fig. 50), gives the precipitation over the city during what is described as a "freak" snowstorm on November 26th, 1903, when 14 inches of snow fell in South Chicago, near the lake, and none over the western sections of the city, where the sun was shining brightly. The extremes of sea level pressure were 30·94 in. (on two occasions) and 28·98 in., the absolute range in 41 years being thus less than 2 inches. It is worthy of note that the absolute highest pressure occurred on January 28th, 1902, three days before an anti-cyclone of great intensity gave record readings slightly above 31·1 inches in the East of Scotland. R.C.M.

METEOROLOGICAL NEWS AND NOTES.

STROMBERG'S SYSTEM OF WEATHER PREDICTION is the subject of an important article, the publication of which we hope to begin next month. It is from the pen of Dr. Hans Pettersson, Lecturer on Geography in the University of Göteborg, son of the distinguished Swedish oceanographer, Professor Otto Pettersson. Dr. Hans Pettersson assists his father at the remarkable oceanographical laboratory which they have established on the island of Bornö in the Gullmar Fjord, one of the inlets of the Skagerrak.

THE SEVEREST WINTER ON RECORD in the Argentine Republic is just coming to an end. Temperatures far below the freezing point have been recorded in places where no previous winter minimum of 32° F. have been known.

THE LIMITS OF THE SEASONS have been under discussion by a London evening newspaper, which suggests on the authority, as they put it, "of a disgruntled pessimist," that Spring should be termed East Wind Season; Summer, Rainy Season; Autumn, Foggy Season; Winter, Wind Season. This was evidently intended as a joke, but bears some resemblance to the new names of the months introduced after the French Revolution, when everything was being placed upon a new, and as events proved often, an unstable basis.

ERRATUM.—Page 95, Table IV., percentage rainfall at Ajo, April, *should be* 515 *not* 15.

RAINFALL TABLE FOR JULY, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875–1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·57	4·10
Tenterden	*Kent*	51 4	*0 41	190	2·21	3·43
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·46	4·31
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·42	4·60
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·43	3·93
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	2·54	3·72
Shoeburyness	*Essex*	51 31	*0 48	13	1·73	2·42
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·68	3·51
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·37	5·53
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	2·74	4·79
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·68	3·75
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·75	3·26
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·58	5·55
Boston	*Lincolnshire*	52 58	0 1	11	2·35	4·98
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	2·35	4·57
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·57	6·41
Macclesfield	*Cheshire*	53 15	2 7	501	3·41	5·45
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	2·92	3·59
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	4·75	5·73
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·56	5·31
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	2·39	5·73
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·90	2·77
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	8·91	11·67
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	3·26	4·75
Haverfordwest	*Pembroke*	51 48	4 58	90	3·39	3·85
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	4·03	3·31
Llandudno	*Carnarvon*	53 20	3 50	72	2·52	4·09
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	3·20	3·94
Marchmont House	*Berwick*	55 44	2 24	498	3·30	4·57
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	3·73	3·89
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	2·91	3·62
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	4·72	6·85
Mull (Quinish)	,,	56 34	6 13	35	4·12	4·16
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·84	3·44
Braemar	*Aberdeen*	57 0	3 24	1114	2·65	3·11
Aberdeen (Cranford)	,,	57 8	2 7	120	3·00	5·65
Gordon Castle	*Moray*	57 37	3 5	107	3·25	4·34
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	2·98	3·01
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	5·35	5·99
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·91	4·43
Wick	*Caithness*	58 26	3 6	77	2·67	2·55
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	3·53	4·33
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	3·13	4·68
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·02	5·56
Ennistymon House	*Clare*	52 57	9 18	37	3·57	5·97
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·90	4·63
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·99	4·79
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·60	5·78
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·16	5·44
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	3·26	4·96
Cong (The Glebe)	,,	53 33	9 16	112	3·72	4·95
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·36	5·47
Seaforde	*Down*	54 19	5 50	180	3·32	4·27
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·28	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·34	5·34

RAINFALL TABLE FOR JULY, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875—1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
+1·53	160	·79	6	15	13·53	18·04	+4·51	133	25·11	Camden Square
+1·22	155	1·20	16	16	13·65	17·60	+3·95	129	27·64	Tenterden
+1·85	175	1·21	16	13	14·92	21·24	+6·32	142	30·48	Patching
+2·18	190	1·35	17	15	15·73	22·04	+6·31	140	31·87	Cadland
+1·50	162	·90	6	19	13·03	16·59	+3·56	127	24·58	Oxford
+1·18	147	·83	6	18	13·76	13·88	+ ·12	101	25·20	Swanspool
+ ·69	140	·50	16	14	9·73	11·16	+1·43	115	19·28	Shoeburyness
+ ·83	131	·69	6	17	13·44	14·33	+ ·89	107	25·40	Westley
+3·16	233	1·00	14	21	11·98	18·51	+6·53	154	23·73	Geldeston
+2·05	175	1·42	16	20	18·62	25·41	+6·79	136	38·27	Polapit Tamar
+1·07	140	·87	16	16	17·01	18·33	+1·32	108	33·54	Rousdon
+ ·51	119	·54	24	18	15·83	16·80	+ ·97	106	29·81	Stroud
+2·97	215	1·20	16	21	16·88	22·63	+5·75	134	32·41	Wolstaston
+2·63	212	1·38	4	21	12·21	13·88	+1·67	114	23·35	Boston
+2·22	194	1·19	16	16	13·15	13·24	+ ·09	101	24·46	Hodsock Priory
+3·84	250	2·47	16	20	14·34	18·65	+4·31	130	26·65	Mickleover
+2·04	160	1·20	16	20	18·17	21·69	+3·52	119	34·73	Macclesfield
+ ·67	123	·78	27	13	15·88	17·61	+1·73	111	32·70	Southport
+ ·98	121	1·06	7	25	31·97	32·80	+ ·83	103	61·49	Arncliffe
+2·75	208	1·40	16	13	14·19	16·85	+2·66	119	26·87	Ribston Hall
+3·34	240	1·74	4	17	13·47	15·71	+2·24	117	26·42	Hull
— ·13	96	·39	27	18	14·45	12·85	- 1·60	89	27·94	Newcastle
+2·76	131	1·50	8	25	65·29	66·91	+1·62	102	129·48	Seathwaite
+1·49	146	1·44	16	25	20·48	21·43	+ ·95	105	42·28	Cardiff
+ ·46	114	1·06	16	15	22·84	26·52	+3·68	116	46·81	Haverfordwest
— ·72	82	·48	19	19	22·15	25·80	+3·65	116	45·46	Gogerddan
+1·57	162	1·06	7	17	14·89	17·72	+2·83	119	30·36	Llandudno
+ ·74	123	·67	15	19	22·26	26·11	+3·85	117	43·47	Cargen
+1·27	138	1·24	7	20	17·68	15·67	—2·01	89	33·76	Marchmont
+ ·16	104	·58	19	18	24·83	27·86	+3·03	112	49·77	Girvan
+ ·71	124	·63	19	20	18·42	17·07	—1·35	93	35·97	Glasgow
+2·13	145	1·37	18	25	34·04	38·59	+6·59	113	68·67	Inveraray
+ ·04	101	·86	18	22	27·67	28·62	+ ·95	103	56·57	Quinish
+ ·60	121	·63	19	19	14·86	14·79	— ·07	100	28·64	Dundee
+ ·46	117	·47	24	25	17·80	21·48	+3·68	121	34·93	Braemar
+2·65	188	1·12	7	24	17·02	18·96	+1·94	111	32·73	Aberdeen
+1·09	133	1·19	14	25	15·52	17·42	+1·90	112	30·34	Gordon Castle
+ ·03	101	·57	3	21	23·20	18·27	—4·93	79	44·53	Fort Augustus
+ ·64	112	·75	19	24	42·90	41·41	—1·49	97	83·93	Bendamph
+1·52	152	1·21	28	17	17·19	...	...	...	31·90	Dunrobin Castle
— ·12	96	...	...	...	15·38	12·72	—2·66	83	29·88	Wick
+ ·80	123	·70	4	28	28·40	27·97	— ·43	98	54·81	Killarney
+1·55	150	1·10	31	19	20·53	20·33	— ·20	99	39·57	Waterford
+2·54	184	·93	6	25	20·53	21·92	+1·39	107	39·43	Castle Lough
+2·40	167	·67	6	28	23·24	25·94	+2·70	112	46·52	Ennistymon
+1·73	160	1·39	31	22	18·32	18·11	— ·21	99	34·99	Courtown Ho.
+1·80	160	1·28	6	25	18·83	19·16	+ ·33	102	35·92	Abbey Leix
+3·18	222	1·04	16	23	14·75	16·90	+2·15	115	27·68	Dublin
+2·28	172	·65	3, 6	29	19·17	23·09	+3·92	120	36·15	Mullingar
+1·70	152	·93	16	29	26·64	27·89	+1·25	105	52·87	Enniscoe
+1·23	133	·77	26	25	25·13	24·63	— ·50	98	48·90	Cong
+2·11	163	·54	22	28	22·19	26·19	+4·00	118	42·71	Markree
+ ·95	129	1·00	6	22	20·74	20·49	— ·25	99	38·91	Seaforde
...	...	...	...	...	18·77	...	...	..	37·56	Dundarave
+2·00	160	1·05	29	28	20·44	22·33	+1·89	109	39·38	Omagh

SUPPLEMENTARY RAINFALL, JULY, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	4·53	XI.	Lligwy	3·87
,,	Ramsgate.....	1·97	,,	Douglas	3·81
,,	Hailsham	4·17	XII.	Stoneykirk, Ardwell House...	3·79
,,	Totland Bay, Aston House...	3·51	,,	Carsphairn Shiel	6·33
,,	Stockbridge, Ashley..	4·59	,,	Beattock, Kinnelhead	4·75
,,	Grayshott	4·88	,,	Langholm, Drove Road	5·22
III.	Harrow Weald, Hill House...	5·85	XIII.	Meggat Water, Cramilt Lodge	4·06
,,	Caversham, Rectory Road ...	5·14	,,	North Berwick Reservoir.....	3·66
,,	Pitsford, Sedgebrook....	3·78	,,	Edinburgh, Royal Observaty.	2·72
,,	Woburn, Milton Bryant.....	4·91	XIV.	Maybole, Knockdon Farm ...	4·00
,,	Chatteris, The Priory..... ...	3·63	XV.	Ballachulish House	5·52
IV.	Elsenham, Gaunts End	4·33	,,	Campbeltown, Witchburn ..	3·02
,,	Colchester, Hill Ho., Lexden	4·40	,,	Holy Loch, Ardnadam.....	5·89
,,	Ipswich, Rookwood, Copdock	3·74	,,	Islay, Eallabus	3·68
,,	Blakeney..... . ..	3·27	,,	Tiree, Cornaigmore	2·75
,,	Swaffham	4·48	XVI.	Dollar Academy	4·84
V.	Bishops Cannings	4·39	,,	Balquhidder, Stronvar.....	...
,,	Wimborne, St. John's Hill ...	4·49	,,	Glenlyon, Meggernie Castle..	3·95
,,	Ashburton, Druid House.....	3·99	,,	Blair Atholl	2·84
,,	Cullompton	4·61	,,	Coupar Angus	3·40
,,	Lynmouth, Rock House	3·75	,,	Montrose, Sunnyside Asylum.	4·81
,,	Okehampton, Oaklands... ...	5·11	XVII.	Alford, Lynturk Manse	5·87
,,	Hartland Abbey.....	4·59	,,	Fyvie Castle	4·44
,,	Probus, Lamellyn.....	4·33	,,	Keith Station	6·27
,,	North Cadbury Rectory.	5·14	XVIII.	Rothiemurchus	4·30
VI.	Clifton, Pembroke Road.....	6·18	,,	Loch Quoich, Loan	10·05
,,	Ross, The Graig	4·50	,,	Drumnadrochit..... ..	3·50
,,	Shifnal, Hatton Grange.....	5·90	,,	Skye, Dunvegan	...
,,	Droitwich.....	6·79	,,	Lochmaddy, Bayhead	1·49
,,	Blockley, Upton Wold.....	3·03	,,	Glencarron Lodge	4·73
VII.	Market Overton.....	6·04	XIX.	Invershin	5·17
,,	Market Rasen	4·91	,,	Melvich	3·70
,,	Bawtry, Hesley Hall	4·10	,,	Loch Stack, Achfary	3·68
,,	Derby, Midland Railway.....	7·39	XX.	Dunmanway, The Rectory ..	7·37
,,	Buxton	...	,,	Glanmire, Lota Lodge.....	5·51
VIII.	Nantwich, Dorfold Hall	4·94	,,	Mitchelstown Castle.....	5·46
,,	Chatburn, Middlewood	3·01	,,	Darrynane Abbey.....	7·54
,,	Lancaster, Strathspey	3·55	,,	Clonmel, Bruce Villa	4·39
IX.	Langsett Moor, Up. Midhope	4·67	,,	Newmarket-on-Fergus, Fenloe	6·02
,,	Scarborough, Scalby	7·64	XXI.	Laragh, Glendalough	...
,,	Ingleby Greenhow	5·12	,,	Ballycumber, Moorock Lodge	4·79
,,	Mickleton	...	,,	Balbriggan, Ardgillan	5·56
X.	Bellingham, High Green Manor	3·52	XXII.	Ballynahinch Castle.....	6·13
,,	Ilderton, Lilburn Cottage ...	5·15	,,	Woodlawn	5·95
,,	Keswick, The Bank.....	4·10	,,	Westport, St. Helens	3·13
XI.	Llanfrechfa Grange	6·17	,,	Dugort, Slievemore Hotel ...	5·22
,,	Treherbert, Tyn-y-waun	11·28	,,	Mohill Rectory	4·64
,,	Carmarthen, The Friary	4·14	XXIII.	Enniskillen, Portora.....	4·35
,,	Fishguard Goodwick Station.	3·22	,,	Dartrey [Cootehill]	4·47
,,	Crickhowell, Tal-y-maes.....	4·60	,,	Warrenpoint, Manor House ..	3·91
,,	New Radnor, Ednol	6·00	,,	Banbridge, Milltown	5·16
,,	Birmingham WW., Tyrmynydd	6·19	,,	Belfast, Cave Hill Road	4·92
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	4·99
,,	Llangynhafal, Plâs Draw.....	2·96	,,	Londonderry, Creggan Res...	5·29
,,	Dolgelly, Bryntirion.....	5·28	,,	Dunfanaghy, Horn Head ...	4·53
,,	Bettws-y-Coed, Tyn-y-bryn...	...	,,	Killybegs	5·88

THAMES VALLEY RAINFALL. ——— JULY 1915.

Symons's Meteorological Magazine

Watershed of River Thames above Teddington, and River Lea above Feildes Weir.

Rainfall Stations reporting Isohyetals

THE WEATHER OF JULY.

THE characteristic features of the weather of July were an excess of rainfall, a deficiency of sunshine, and a mean temperature markedly below the normal, the days' relative to the average being much cooler than the nights. High day temperatures over the greater part of the country were conspicuous by their absence, and low night temperatures were equally rare.

The month opened with a high pressure system spreading in from the Atlantic, which in England was associated with generally dry weather. On the 3rd a depression approaching the coast of Ireland led to the development of local thunderstorms. At many places the 3rd and 4th were the warmest days of the month, the shade maximum on the 3rd rising to 86° at Greenwich, 84° at Camden Square, and 83° at Southend-on-Sea, while in the north of Scotland, Lerwick recorded a maximum of 61°, and places as far apart as Wick and Blacksod Point, 62°. Even higher temperatures were noted on the 4th, viz., 87° at Greenwich, 86° at Camden Square, and 85° at Kew, but readings exceeding 80° were restricted to places in the east and south-east of England, while in the north of Ireland the maximum recorded did not exceed 69°. Very heavy falls of rain and hail occurred during the thunderstorms of the 4th, 2·56 in. falling at Skegness and 1·74 in. at Hull.

On the 6th a depression which came in from the Atlantic caused general rains over the British Islands. In the west of Ireland less than an inch fell in most districts, but falls of 1·70 in. at Dunmanway, 1·60 in. at Dungeon Ghyll, and 1·57 in. at St. Ives were reported, while at Oughtershaw, in Yorks, 3·02 in. fell on the 6th and 7th. From the 8th to the 13th the only pronounced dry spell noted anywhere during the whole month prevailed over the southern half of England. The approach of a deep depression from the Atlantic on the 16th caused widespread and heavy rains as it moved over the Midlands, expecially in the Soar Valley, where more than 3 inches fell. The maximum falls so far reported are Barrow, 3·12 in., Kingston, 2·84 in., and Derby, 2·56 in. Over Ireland the fall in general was less than 2 inches, but at Dublin as much as 2·84 in. was measured. This disturbance was associated with strong northerly winds and a low temperature which failed to reach 60° in several districts.

During the second half of July shallow disturbances moving in a generally S.W. to N.E. direction caused cool rainy conditions and frequent thunderstorms. On the 23rd at Middlesbrough 1·84 in. fell between 2.45 and 4 p.m., and on the 27th thunderstorms and torrential rains were general.

Rainfall was above the average nearly everywhere and more than twice the normal fell over the Midlands. A slight deficiency was noted at Newcastle, near Fort William, and in Cardigan. In England the greatest excess was west and north of Leicester, where from 8 to 9 inches fell, although considerably more fell in the normally wet areas in Cumberland and Glamorgan. The driest region was a small area near Margate with less than 2 inches. The whole of Ireland had over 4 inches, and in Scotland the driest area was in the estuary of the Forth, with less than 3 inches.

The Thames Valley map shows that more than five inches of rain fell over parts of three parallel bands crossing the Valley from S.W. to N.E., while a little more than three inches fell in the districts between. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was as follows :—England and Wales, 155; Scotland, 125; Ireland, 158; British Isles, 148.

Sunshine was moderate, the following amounts being reported :—Camden Square, 163 hours; Totland Bay, 234 hours; Copdock, 185 hours; Sidmouth, 191 hours; Weymouth, 235 hours; Ashbourne, 145 hours; Felsted, 210 hours; Southport, 194 hours; Hull, 122 hours; Haverfordwest, 209 hours; Paisley, 169 hours; Loch Stack, 124 hours; Swinton, 132 hours.

In London (Camden Square), the mean temperature was 62°·0, or 1°·5 below the average. Duration of rain 44·7 hours. Evaporation 2·50 inches.

Climatological Table for the British Empire, February, 1915.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
								(0-100)			inches		
London, Camden Square	51°9	4	24°7	25	46°7	34°7	36°6	87	86°4	20°6	3·42	18	7·2
Malta	63·3	15	43·0	27	60·6	49·6	...	86	141·0	...	2·09	10	1·8
Lagos	91·0	3	73·0	2	88·9	77·5	75·2	75	153·0	71·3	1·59	4	6·3
Cape Town	98·1	15	52·3	25	83·7	62·4	58·2	62	...	...	·00	0	1·8
Natal, Durban ...	90·0	11	65.0	14	83·6	71·2	70·2	77	...	...	9·66	8	6·7
Johannesburg	85·9	26	48·9	20	76·4	57·6	59·1	84	...	48·8	5·04	8	5 2
Mauritius	90·5	12	70·5	6	86·8	74·2	71·4	76	...	64·8	10·12	21	6·1
Bloemfontein	89·3	27	52·3	23	83·0	60·3	57·7	63	..	...	5·39	11	4·8
Calcutta...	93·1	17	53·1	13	84·1	61·0	57·8	62	...	41·9	·39	1	2·1
Bombay...	86·9	21	62·5	19	82·2	68·5	64·0	70	134·0	46·8	·30	1	1·3
Madras	90·5	5	66·3	10	86·7	71·1	69·5	77	156·8	63·3	·30	1	2·9
Colombo, Ceylon ...	97·2	23	67·7	3	89·8	72·3	73·5	80	163·7	61·8	5·42	5	4·6
Hongkong	79·0	10	49·8	19	67·8	59·4	58·5	81	...	...	·51	6	8·3
Sydney	94·8	21	58·5	27	81·6	67·7	63·6	70	152·4	49·9	1·31	14	6·0
Melbourne	103·8	15	47·5	24	77·8	58·0	53·2	59	155·1	41·3	·79	10	5·2
Adelaide	109·8	1	52·9	26	89·5	65·3	52·8	39	160·8	41·4	·04	2	3·7
Perth	107·3	12	56·0	16	84·8	64·9	60·1	61	163·0	49·0	2·98	8	3·8
Coolgardie	107·6	13	54·8	16	86·6	64·1	59·0	58	160·8	53·8	3·25	10	5·0
Hobart, Tasmania ..	88·2	13	45·0	10	71·3	54·1	48·4	60	151·3	36·3	2·18	13	6·7
Wellington	77·4	27	42·6	20	67·6	55·9	52·1	72	144·6	32·2	1·25	7	7·5
Auckland	77·5	15	52·5	20	71·7	58·8	58·0	78	148·0	49·0	·65	5	6·1
Jamaica, Kingston ...	88·5	4	65·1	12	..	...	66·9	74	...	...	·83	3	...
Grenada	87·0	28	71·0	14	84·1	73·5	...	73	135·0	...	1·23	9	2·5
Toronto	42·3	14	2·9	3	31·8	20·3	20·6	84	107·5	0·2	2·65	16	6·9
Fredericton	44·2	25,26	-19·0	4	32·3	-19·0	17.0	83	...	..	3·28	13	5·7
St. John, N.B. ...	47·4	25	-10·5	2	33·0	18·4	20·0	78	..	...	3·44	13	5·9
Alberta, Edmonton ...	40·1	15	-12·2	1	26·3	3·4	...	92	96·0	-16·8	·06	2	5·4
Victoria, B.C.	52·2	9,27	34·0	19	47·7	39·0	39·0	84	...	...	·98	15	7·5

Johannesburg.—Bright sunshine 211·7 hours.

Mauritius.—Mean temp. 1°·2, dew point 0°·3, and R 3·09 in. above, averages. Mean hourly velocity of wind 1·3 miles above average.

COLOMBO, CEYLON.—Mean temp. 81°·0 or 0°·8 above, dew point 2°·7 above, and R 3·44 in. above, averages. Mean hourly velocity of wind 5·4 miles. TS on 8th and 28th.

HONGKONG.—Mean temp. 63°·6. Mean hourly velocity of wind 13·1 miles. Bright sunshine 82·6 hours.

Melbourne.—Mean temp. 0°·5 above, and R ·91 in. below, averages.

Adelaide.—Mean temp. 3°·4 above, and R ·58 in. below, averages.

Coolgardie.—Rainfall 2·60 ins. above average.

Hobart.—Mean temp. 0°·3, and R ·76 in. above, averages.

Wellington.—Mean temp. 0°·5 below, and R 2·18 in. below, averages. Bright sunshine 162·7 hours.

Auckland.—Cool, dry and cloudy. Rainfall less than a fifth of the average. Mean temp. nearly 2° below average.

ALBERTA, EDMONTON.—Warm, sunny, calm and damp with very little snow.

Symons's
Meteorological Magazine.

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ON WEATHER FORECASTS AND THE TEMPERATURE PREDICTIONS OF STRÖMBERG.

By Dr. Hans Pettersson.

There are few if any scientific problems more fitted to attract general interest than those which have a bearing on weather predictions and climatic forecasts. Of the methods actually used for that purpose we may here pass over the most primitive, in which an important part is played by various physical ailments of the (generally aged) expert. Quite a different degree of confidence is naturally evoked by the simple rules and acute observations on which experienced farmers and weather-worn sailors base their forecasts of the local weather, very often with surprisingly correct results.

The official weather predictions issued by the meteorological offices of most civilized countries have, of course, a much more far-reaching importance. An intimate knowledge of the dynamical laws governing the lower strata of the atmosphere, combined with a vast system of organized international observation, enable meteorologists to foretell what state of weather is likely to prevail during the next 24 or 48 hours. A particularly useful kind of such short-range forecasts are the storm-signals, given for the benefit of the fishing and shipping industries, which have wrung a decided, although somewhat reluctantly granted, approval from the followers of these professions.

An altogether different kind of forecast is that which aims at predicting the average character of a coming season, months in advance. That such long-range forecasts are theoretically possible was first proved by Prof. Otto Pettersson. In a paper published in 1896 he draws attention to the intimate correlation which exists between the air temperature over Scandinavia in the winter and the surface temperature of the Norwegian Sea. Figure 1, which is taken from his paper, shows how the average air temperature (thin line) of February at Örebro (central Sweden), varies from year

to year, together with the simultaneous fluctuations in the temperature of the surface water off the west coast of Norway. The parallelism is certainly striking, and it is worthy of note how much larger are the temperature variations of the atmosphere than of the sea, obviously in consequence of the enormously higher heat-capacity of water than of air. Other curves no less convincing

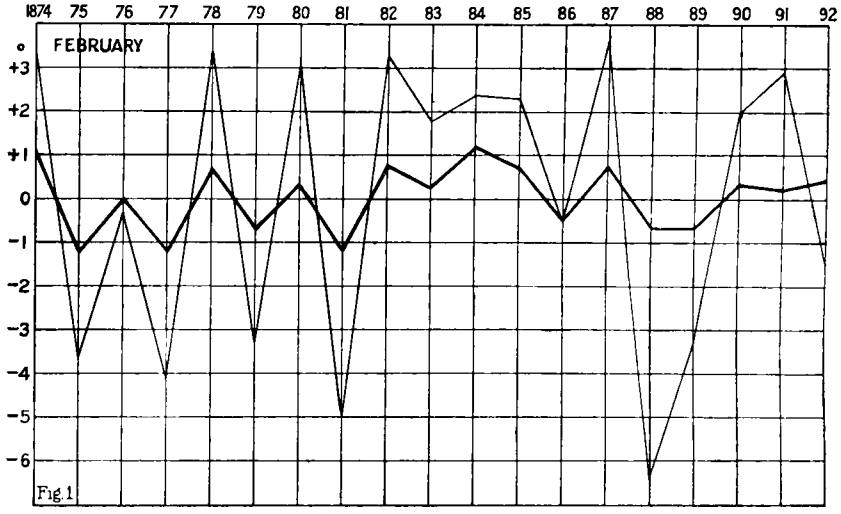
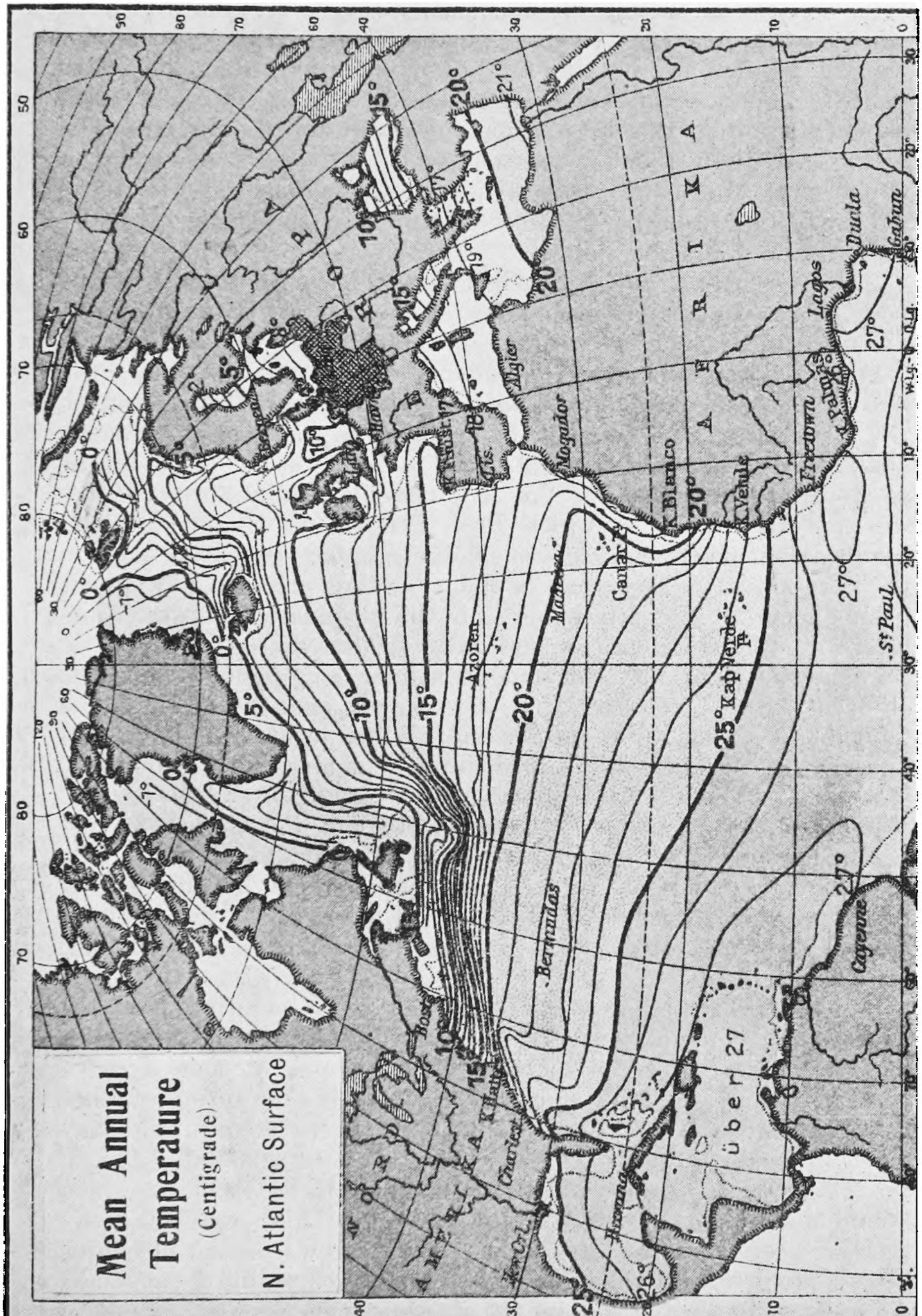


Fig. 1.—Parallelism between Air-Temperature at Orebro and Surface Temperature of Norwegian Sea.

are also given in this paper, proving that similar correlations exist between the length of the Swedish winter (number of days with snow-covered ground), and the arrival of spring (commencement of ploughing), on one side, and the average surface temperature of February on the other.

Recent investigations by Prof. J. W. Sandström have revealed the vast system of atmospheric circulation, which is the immediate cause of this remarkable interdependence.

As a further proof of the large extent to which our climate is influenced by the ocean, expecially in winter, I have reproduced in Figure 2 a map showing the annual isotherms of the N. Atlantic surface. Their conspicuous northward trend along the coasts of north-western Europe is the direct cause to which we owe our abnormally mild winter climate. If, now, large areas of this "hot-water pipe" of our part of the world undergo parallel variations in temperature from year to year (and such fluctuations have actually been proved to exist by the recent investigations of Prof. Fridtjof Nansen and Prof. Helland-Hansen), then these cannot fail to have a corresponding influence on the European climate, By systematic investigation of the heat-supply carried by the vast


Mean Annual
Temperature
(Centigrade)
N. Atlantic Surface
Bermudas
Azoren
Madeira
Canar
Kapverde
Algier
Mogador
K. Blanco
Freetown
Lagos
Duala
Gabun
Cayenne
St Paul
New Orl.
Charlest.
Bost.
A F R I K A
über 27

warm currents along the coast of N. America, one should, therefore, be able to foretell an abnormally severe or mild European winter. One may hope to gain valuable clues in this way also for rainfall predictions, as the rate of evaporation from the ocean depends largely on its surface temperature. It is, therefore, most satisfactory that the International Council for the investigation of the sea is now about to extend its field of research to the larger expanse of the North Atlantic. The Meteorological Offices of Great Britain and of Holland are already publishing valuable material on the same subject.

Quite recently a young Swedish astronomer, Dr. Gustaf Strömberg, has made a most interesting attempt at a new kind of long distance forecasts of the weather or rather of the air-temperature. When the large submarine (boundary) waves, discovered by Prof. Otto Pettersson on the west coast of Sweden, were being studied, Dr. Strömberg had assisted by making a so-called "harmonic analysis" of the wave record. The object was to trace in the phenomenon the effect of the long-periodical tidal forces of the sun and the moon, to which Prof. Pettersson's climatic theories ascribe a far-reaching influence on the oceanic circulation and on the climate. The fact that boundary waves are also a frequent phenomenon in the atmosphere on the boundaries between air-layers of different densities, naturally suggested that atmospheric phenomena might also respond to similar long-period influences. It occurred to Strömberg that a harmonic analysis of the same kind might be made on the air-temperature records of Stockholm and Upsala. The results of a preliminary analysis were promising, and Dr. Strömberg was encouraged by several Swedish men of science to pursue his investigations, the not inconsiderable cost being defrayed by liberal grants from private donors.

It may be of interest to give here a brief sketch of the method employed, the harmonic analysis, which, thanks to the work of Lord Kelvin and others, has given such brilliant results at tidal predictions.

Suppose that we have plotted a curve representing how the average daily temperature of a certain locality varies during a number of years. To predict the future course of such a curve from its past is obviously impossible if there is no kind of relationship between different parts of that curve, if its course, from any given day and onwards, is merely a matter of chance. But, on the other hand, *if there are persistent elements of regularity*, law-bound fluctuations, present in the curve, but obscured, either by their number or by the interference of other and irregular elements, then a prediction of at least partial correctness should be possible.

From a mathematical point of view the simplest kind of "regular," *i.e.*, periodically fluctuating curves, is the so-called sine-curves ($y = A \sin x$, where A is a constant), a kind of wave-

line with constant amplitude or "height of the waves," and constant period or "wave-length." Two different sine-curves are given in Figure 3, I. and II. (AB = CD = EF; AC = CE and ab = cd = ef; ac = ce). Curve III. is the graphical sum of I. and II., its ordinates (vertical distance of the curve from its axis, $a\Delta$), being everywhere equal to the sum of the homologous ordinates in the two simple curves ($a\beta$ = AB+a_1b_1 and $\Delta\gamma$ = CD—c_1d_1). The shape of Curve III. is evidently of a much more complex regularity than that of its components. If now, instead of only two sine-curves, twenty or thirty had been added together, the resultant curve would obviously have become so complex that a

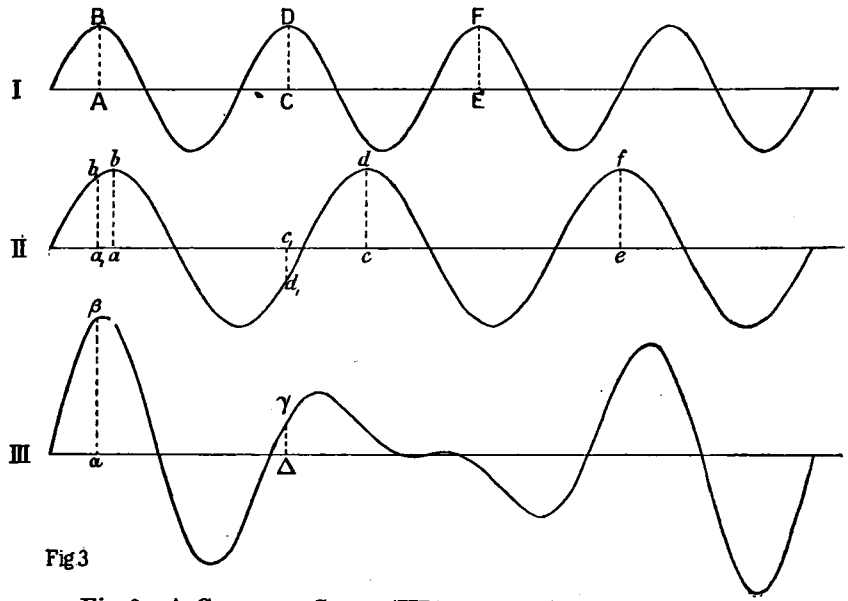


Fig. 3.—A COMPLETE CURVE (III.) AND ITS SIMPLE COMPONENTS, SINE-CURVES (I. AND II.).

prediction of its future course from a certain point would be practically impossible. But if one could only resolve such a complex curve into its simple components, then from the future courses of all these (which are self-evident), the future course of their sum could be synthetized. By means of a harmonic analysis such a resolution of a complex curve into elementary waves (or rather their *extrication* from the mother-curve), can be realized. *

Suppose that we want to find out whether there is a periodicity of, say, 20 days' length present in the record mentioned above. For that purpose we must first divide the whole length of the

*A similar analysis is achieved by any musical person when he distinguishes by the ear the different simple musical tones from which an intricate struck on the piano is built up.

curve into equal fractions, each 20 days long. Then through a simple but laborious arithmetical operation (taking mean values from homologous ordinates), we construct the *average shape* of all the fractions. In a similar way one may find the characteristic features of a family by photographing its different members on the same negative. Now if there is no persistant periodicity of the given length present in the curve, there will be no "family likeness" between its different fractions; and their average shape will be an irregular line which deviates from the straight axis only by small amounts according to the law of errors. But if there *is* really such a periodicity hidden in the curve, then the "family likeness" will come out in the result, the average shape being in the simplest case, one complete wave of a sine-curve twenty days long. The amplitude of that elementary temperature wave evidently denotes to what extent the temperature curve is influenced by a periodicity of 20 days. And all along the length of the record investigated an uninterrupted train of such sine-waves must be considered to run, although they may be completely obscured by other superposed variations, periodical or unperiodical.

Being under the influence of Prof. Pettersson's climatic theories, Dr. Strömberg at first only tried to find temperature-waves of the same length as the lunar periods or derivable from these in conjunction with solar periods. He afterwards made an unprejudiced analysis testing the record for all periodicities between 20 and 40 days long, and varying the length of the investigated period by only ·02 of a day at each new attempt. No less than between 30 and 40 different elementary temperature waves have thus been extricated from the last thirty years' record of Stockholm, their amplitudes varying between $\pm 0°{\cdot}17$ C and $\pm 0°{\cdot}30$ C, *i.e.*, a total fluctuation due to each of from $0°{\cdot}35$ C to $0°{\cdot}60$ C. On the other hand it can be proved that any fictitious periodicity, which might be artificially produced by testing sharpness of the analysis, would, according to the law of errors, have an average amplitude of only $\pm 0°{\cdot}05$ C. There is, consequently, a wide margin between that value and the amplitude of the smallest waves accepted by Dr. Strömberg as actually present in the record.

However, as a further proof of the real existence of these temperature waves, Strömberg has checked his calculations by dividing the investigated record into two equal parts and analysing each part separately. Not only do the same waves then come out in both parts, but even their amplitudes are approximately the same, and also their "angles of phase" are practically identical, so that the train of each wave running through the first part of the record is smoothly linked up with its partner in the second half without any discontinuity, *i.e.*, without any sudden change of phase at the point of division.

(*To be continued*).

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE SEASONS: THE FINAL REPLY.

In his letter last month Mr. Ellis touches points concerned with two principles which I have for a long time past been labouring to get more thoroughly understood. Firstly, it is not the air temperature alone considered that is held in primary regard by living creatures, but it is the air temperature taken in conjunction with the effects of direct radiation of heat and light which transcends any other meteorological element. If, for example, we compare a rather cool bright day with a shade temperature say between 65° and 70° in the high solstitial month of June with a similar day of the same temperature in the transitional equinoctial month of September.* We are forced to admit that the June day is, in a more complete sense, the hotter, because in that month the sun's rays smite the ground like a shaft, whereas in September they are much milder, and not generally felt to be oppressive unless associated with a high air temperature like 80°. Indeed, I fail to see how some of the seasonal habits of animal life can be interpreted except on the supposition that they are even more closely related to radiation than to air temperature.

The second principle brought out by the examination of Mr. Ellis's letter is one which strikes me with overwhelming force every May and November—solstitial months not included in the conventional summer and winter. Mr. Ellis apparently regards the incidence of the thunderstorm season around the summer solstice and of the cyclonic gale and the fog season around the winter solstice as an "accidental" relationship, in so far, that is to say, as the arrangement of the seasons should be concerned. The relationship, however, is of fundamental importance, not indeed so much because of the phenomena of gales and thunderstorms themselves, which only occur from time to time, as because their frequency and intensity is an index that the general body of the atmosphere is under *solstitial control*—by a direct physical process in the case of thunderstorms at the high solstice, and by an indirect process in the case of cyclonic gales and of fogs at the low solstice.† Everyone will of necessity admit this; yet they cannot follow my constant assertion variously expressed that solstitial control over pressure distribution and weather types is the first and foremost

* It is obvious that for such equality of temperature to occur, the air on the June day must be of cooler *origin*.

† The energy, concentrated in local patches, of our summer thunderstorms proceeds from solar action; the more uniform energy of our winter gales is an indirect result of the absence of powerful insolation.

meaning of summer and winter, even though the general level of air temperature is higher and lower respectively in the first equinoctial than in the first solstitial months. In all the diverse characterisation of sky and weather which mark the effects of intense insolation, the month of May is kith and kin with June and July, a fact splendidly illustrated by the similar thunderstorm energy of May in spite of the lower temperature. Therefore, I say it is monstrously incorrect to exclude May from an arrangement which includes either three or four months of summer.

To turn now to Mr. Luttrell's letter, I hardly think he has a clear idea of the question at issue, for there is nothing in my four previous contributions to this subject that can possibly justify his charge of my disregarding the Atlantic influence on the climate of the British Isles; moreover, the matter is rather beside the mark; but I will take Mr. Luttrell a step farther in his own direction than he thought, perhaps, of going. I am aware that in extremely oceanic regions like Valentia and our western sea-board generally, where the change of temperature from month to month is very small, September and March are warmer and colder respectively not only than May and November, but slightly so even than June and December. Does Mr. Luttrell then, as logically he ought, put forth this small excess of air warmth in September as an argument for replacing June by September among the three months of the oceanic summer? or does he more wisely perceive that such a trifling temperature concern is completely drowned by the equinoctial conditions of September with the on-coming winter storms?

As regards the question of snowfall, broached by Mr. Luttrell, I believe I am right in saying that no month of the year in England can be pronounced absolutely immune from frost and snow. In the warmer southern localities, however, like London, away from the chilling influence of mountains, the chances of anything that could fairly be called a snowstorm, are almost nil in each of the six months May to October. Now April is far more prone to snow than October, yet no meteorologist on that account denies to the former its legitimate place in the summer half year, and we have a whole host of summer migrant birds willing to brave a little touch of ice and snow in sunny April that would be frightened out of their wits, if forced to stay here during the chill, darkening days of October. If meteorologists, in short, arrange the *six* months of summer by the sun, why will they not be consistent and judge the *three* months of summer by the same standard?

It is to be noted by the way that Mr. Luttrell's letter contains a curious little clause to the effect that in the west country "summer seldom asserts itself before *mid*-summer" (italics mine). By "midsummer," I take it that he is here thinking of the June solstice, and if so he is conceding the very point at issue, and we may part company with a cordial handshake. His remarks about

the seasonal peculiarities of the west of England, are, of course, just another way of saying that the mean temperatures lag behind the solstices, is even more marked in the sea-ward projecting western counties than it is "up-country." It may be noted, however, in passing, that in some years even in England the only severe cold spell of a winter occurs in November, *e.g.*, winter of 1904-5, and the only severe heat of a summer in May, *e.g.*, 1913, when for six consecutive days the temperature rose above 80° in the shade, with sultry nights.

From his letter in the July number the Rev. G. Weston seems aware of the hard contest between May and August that will always be fought if we try and limit the summer to three months. But inasmuch as the solstitial periods are longer than the equinoctial, roughly embracing four months each against only two each for the latter, a scientific escape from the difficulty is afforded in making the summer consist of the four months May to August, and the winter of the four months November to February. It will be found on studying the almanac that as early as April 22nd, and as late as August 22nd, the sun's declination is nearer that of the summer solstice than that of the equinoxes; and a similar relationship exists in the winter, except that the winter solstitial period is somewhat shorter than the summer. I am arguing not so much for the exclusion of August and February from the summer and winter respectively as for the necessary inclusion of May and November.

Finally, in taking leave of my critics, I would ask them in further reflection to reduce the matter to its elements by casting the names "spring," "summer," "autumn," and "winter," into the melting pot, and fixing their attention on the idea of *family* relationship between the months. Then let them answer the following question :—Is the seasonal lag in the air-temperature viewed in the light of the full climatic picture of sufficient magnitude *really* to justify the division of such clearly marked natural groups of three months as are indicated, on the one hand, by the 4 p.m. night-fall, and, on the other hand, by the 9 p.m. day-light? This is a searching inquisition, but every individual answer, whensoever it is made, will be the more valuable on that account.

L. C. W. BONACINA.

LIGHTNING HOLES.

With reference to Mr. Dines' letter *re* holes caused by lightning, on page 97 of July, 1915, *Meteorological Magazine*, I think the holes may have been caused by an *upward* stroke of lightning from the ground; as I remember seeing a flag pole on a Torquay house and a telegraph post on a Cornish moor, that had been struck by

lightning, showed wood strips apparently chiselled out from *below* towards the middle of the post, and above the middle had been chiselled from above; I fancy lightning sometimes strikes in both directions (from above and below), but is only *visible* in one direction.

E. E. GLYDE.

323, Ross Street, Edmonton, Alberta, Canada.

YET more conclusive instances of "lightning holes" are on record than is mentioned on page 108 of your last number. At page 60, Vol. **45** (1889), of the Geological Society's *Quarterly Journal*, the late Mr. F. Rutley describes fulgurites from Monte Viso, obtained by the late Mr. James Eccles, from close to the summit of that peak (12,609 feet). The rock was one of the *Grünen-schiefer* group (with some glaucophane), and in it channels had been ploughed which were lined with a glass. In the same journal, Vol. **52** (1896), page 452, I described (in a joint paper with Miss Aston), specimens, brought by the same geologist and Alpine climber, from the summit of the Riffelhorn (9,617 feet), which he presented to the Geological collection at University College. Some of these fulgurites are actual tubes, which might be compared to small worm-burrows, coated with a film of very dark glass, the rock being an antigorite-serpentine. In F. A. Fitzgerald's "Highest Andes," (1899), I describe at page 325, fulgurites in blocks of hornblende-andesite, from the summit of Tupungato (20,260 feet). These also are channels and tubes, sometimes branching, as in the other instances, fairly circular in section, often from one-fifth to one-third of an inch in diameter, and with a rather thin coating of bottle-green glass. The description is reprinted in the *Geological Magazine* (1899, page 1).

T. G. BONNEY.

DEFINITION OF A "PARTIAL RAIN SPELL."

FROM the 28th of June to the 17th of August we never had two consecutive days without rain, but as there were some rainless days interspersed among the 37 rain days during that period, it cannot be spoken of as a "rain spell."

It seems a pity that no definition has been agreed upon for a *partial* rain spell, similar to that for a partial drought, to designate a period in which there has been a long succession of wet days, although a few rainless days have precluded it from being called an absolute rain spell. It would be interesting if any suggestions as to the actual form of the definition were made in this magazine. My own opinion is that the definition might run: "*A Partial Rain Spell* is a period of more than 28 consecutive days in which there were never more than two consecutive days without rain."

A. E. SWINTON.

Swinton House, Duns, 1st September, 1915.

REVIEW.

Republica de Chile. Anuario del Servicio Meteorológico de la Direccion del Territorio Maritimo, 1910.; (Annual of the Maritime Meteorological Service of Chile, 1910). Valparaiso, 1912. Size $10\frac{1}{4}+7\frac{1}{4}$. Pp. 7 + 464, and plates.

THIS work gives *in extenso* the tri-daily observations carried on at 18 stations on the Chilian littoral during the year 1910, and concludes the 12 years' work of the Maritime Weather Service, which was amalgamated in 1911 with the newly constituted Meteorological and Geo-Physical Institute. The stations cover nearly 35° of latitude, and thus the records embrace all varieties of climate. At the two northern stations of Arica and Iquique no rain fell in 1910, while at Evangelists Island near the Pacific entrance to Magellan Straits 124·20 in. fell on 314 days, with a maximum daily fall, however, of only 2·44 in. The month of December was rainless at some wet stations situated in lat. 40°S, this being the first instance of a month without rain in this region. Although some of the material requires to be subjected to a critical examination or analysis before being utilised for scientific purposes, the *Territorio Maritimo* deserve every credit for having prepared and published annually since 1899 the reports of which the one under notice is the final issue. In spite of the great strides made in other directions since the beginning of the century by several Weather Services in the Southern Continents, none has given their annual reports in such a complete form as Chile. In connection with the new and wider outlook into meteorological problems, more particularly those relating to long range forecasting, it is absolutely necessary that the Southern Weather Services should each publish promptly a monthly bulletin of the more essential data. This is already done by Australia and New Zealand, and until recently by Argentina, which gave monthly maps without the numerical data. Other services will, however, have to fall into line in this direction if the sum and substance of Southern Hemisphere meteorology is to be promptly utilised for practical purposes, more particularly in connection with agriculture. R.C.M.

METEOROLOGICAL NEWS.

SNOW FELL IN KIMBERLEY, SOUTH AFRICA this winter, an event of the utmost rarity, in commenting upon which Mrs. Sutton says in a letter dated July 29th, "people all turned out to snowball, and the natives, many of whom had never seen such a sight before, were most excited. My native charwoman told me when she woke in the morning, that she thought some one had been breaking into the shops, and had scattered flour all over the place!"

RAINFALL TABLE FOR AUGUST, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·39	2·27
Tenterden	*Kent*	51 4	*0 41	190	2·42	1·56
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·52	2·35
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·85	1·83
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·44	1·31
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	2·36	2·03
Shoeburyness	*Essex*	51 31	*0 48	13	1·74	2·88
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·52	2·13
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·22	1·65
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	3·17	2·21
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·84	1·91
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·90	3·53
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	3·43	3·45
Boston	*Lincolnshire*	52 58	0 1	11	2·39	2·56
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	2·55	3·18
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·80	2·69
Macclesfield	*Cheshire*	53 15	2 7	501	3·76	3·52
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	3·73	3·57
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	5·62	4·02
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·78	1·93
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	3·05	2·29
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	3·20	2·25
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	11·47	4·25
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	4·54	1·66
Haverfordwest	*Pembroke*	51 48	4 58	90	4·21	1·76
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	4·88	2·56
Llandudno	*Carnarvon*	53 20	3 50	72	3·16	3·26
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·23	2·70
Marchmont House	*Berwick*	55 44	2 24	498	3·54	3·35
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	4·54	1·66
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·62	...
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	6·02	3·05
Mull (Quinish)	,,	56 34	6 13	35	5·00	1·95
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	3·34	3·67
Braemar	*Aberdeen*	57 0	3 24	1114	3·63	3·04
Aberdeen (Cranford)	,,	57 8	2 7	120	3·07	1·46
Gordon Castle	*Moray*	57 37	3 5	107	3·29	3·16
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	3·52	3·00
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	6·61	6·90
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·71	1·02
Wick	*Caithness*	58 26	3 6	77	2·73	·90
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	4·57	3·29
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	3·73	2·36
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	4·04	3·43
Ennistymon House	*Clare*	52 57	9 18	37	5·01	3·79
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·31	2·69
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·94	2·93
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	3·08	2·38
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	4·00	5·37
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	4·68	3·01
Cong (The Glebe)	,,	53 33	9 16	112	4·70	4·66
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	4·30	3·21
Seaforde	*Down*	54 19	5 50	180	3·64	3·56
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	4·06	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	4·22	3.24

RAINFALL TABLE FOR AUGUST, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875—1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
— ·12	95	·54	2	16	15·92	20·31	+4·39	128	25·11	Camden Square
— ·86	64	·37	17	12	16·07	19·16	+3·09	119	27·64	Tenterden
— ·17	93	·70	16	12	17·44	23·59	+6·15	135	30·48	Patching
—1·02	64	·80	31	13	18·58	23·87	+5·29	128	31·87	Cadland
—1·13	54	·53	2	16	15·47	17·90	+2·43	116	24·58	Oxford
— ·33	86	·51	2	16	16·12	15·91	— ·21	99	25·20	Swanspool
+1·14	166	·62	16	15	11·47	14·04	+2·57	122	19·28	Shoeburyness
— ·39	85	·54	16	17	15·96	16·46	+ ·50	103	25·40	Westley
— ·57	74	·35	12, 16	20	14·20	20·16	+5·96	142	23·73	Geldeston
— ·96	70	·72	1	13	21·79	27·62	+5·83	127	38·27	Polapit Tamar
— ·93	67	·59	5	11	19·85	20·24	+ ·39	102	33·54	Rousdon
+ ·63	122	1·23	2	18	18·73	20·33	+1·60	109	29·81	Stroud
+ ·02	101	1·31	2	18	20·31	26·08	+5·77	128	32·41	Wolstaston
+ ·17	107	·79	2	12	14·60	16·44	+1·84	113	23·35	Boston
+ ·63	125	·57	15	18	15·70	16·42	+ ·72	105	24·46	Hodsock Priory
— ·11	96	·54	2	18	17·14	21·34	+4·20	124	26·65	Mickleover
— ·24	94	·61	3	15	21·93	25·21	+3·28	115	34·73	Macclesfield
— ·16	96	·66	16	14	19·61	21·18	+1·57	108	32·70	Southport
—1·60	72	·65	16	18	37·59	36·82	— ·77	98	61·49	Arncliffe
— ·85	69	...	...	...	16·97	17·78	+1·81	105	26·87	Ribston Hall
— ·76	75	·45	10	18	16·52	18·00	+1·48	109	26·42	Hull
— ·95	70	·38	28	17	17·65	15·10	—2·55	86	27·94	Newcastle
—7·22	37	1·13	31	18	76·76	71·16	—5·60	93	129·48	Seathwaite
—2·88	37	·49	2	20	25·02	23·09	—1·93	92	42·28	Cardiff
—2·45	42	·96	1	11	27·05	28·28	+1·23	105	46·81	Haverfordwest
—2·32	52	·73	1	16	27·03	28·36	+1·33	105	45·46	Gogerddan
+ ·10	103	·64	8	14	18·05	20·98	+2·93	116	30·36	Llandudno
—1·53	64	·80	15	19	26·49	28·81	+2·32	109	43·47	Cargen
— ·19	95	·58	28	17	21·22	19·02	—2·20	90	33·76	Marchmont
—2·88	37	·44	31	16	29·37	29·52	+ ·15	101	49·77	Girvan
...	...	..	...	...	22·04	...	...	...	35·97	Glasgow
—2·97	51	·37	8	21	40·06	41·64	+1·58	104	68·67	Inveraray
—3·05	39	·35	10	19	32·67	30·57	—2·10	94	56·57	Quinish
+ ·33	110	·58	28	17	18·20	18·46	+ ·26	101	28·64	Dundee
— ·59	84	·65	13	16	21·43	24·52	+3·09	114	34·93	Braemar
—1·61	48	·50	2	17	20·09	20·42	+ ·33	102	32·73	Aberdeen
— ·13	96	·87	5	21	18·81	20·58	+1·77	109	30·34	Gordon Castle
— ·52	85	·74	5	21	26·72	21·27	—5·45	86	44·53	Fort Augustus
+ ·29	104	1·77	5	19	49·51	48·31	—1·20	98	83·93	Bendamph
—1·69	38	·25	6	13	19·90	...	...	...	31·90	Dunrobin Castle
—1·83	...	...	..	...	18·11	13·62	—4·49	...	29·88	Wick
—1·28	72	·73	11	21	32·97	31·26	—1·71	95	54·81	Killarney
—1 37	63	·36	8,10	13	24·26	22·69	—1·57	94	39·57	Waterford
— ·61	85	·45	11	18	24·57	25·35	+ ·78	103	39·43	Castle Lough
—1·22	76	1·25	31	16	28·25	29·73	+1·48	105	46·52	Ennistymon
— ·62	81	·42	14	17	21·63	20·80	— ·83	96	34·99	Courtown Ho.
—1·01	74	·41	1	19	22·77	22·09	— ·68	97	35·92	Abbey Leix
— ·70	77	·38	1	16	17·83	19·28	+1·45	108	27·68	Dublin
+1·37	134	·86	12	19	23·17	28·46	+5·29	123	36·15	Mullingar.
—1·67	64	·38	5	20	31·32	30·90	— ·42	99	52·87	Enniscoe
— ·04	99	·88	12	18	29·83	29·29	— ·54	98	48·90	Cong
—1·09	75	·51	13	22	26·49	29·40	+2·91	111	42·71	Markree
— ·08	98	·70	3	18	24·38	24·05	— ·33	99	38·91	Seaforde
...	...	...	..	...	22·83	...	...	...	37·56	Dundarave
— ·98	77	·41	9	19	24·66	25·57	+ ·91	103	39·38	Omagh

Errata—Inveraray, June, Diff. from Av. +2·42
" " July. " " +4·55

SUPPLEMENTARY RAINFALL, AUGUST, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road .	2·75	XI.	Lligwy	2·56
,,	Ramsgate	2·00	,,	Douglas	2·01
,,	Hailsham	1·39	XII.	Stoneykirk, Ardwell House...	1·45
,,	Totland Bay, Aston House...	·89	,,	Carsphairn Shiel	3·50
,,	Stockbridge, Ashley..	1·45	,,	Beattock, Kinnelhead	2·76
,,	Grayshott	3·13	,,	Langholm, Drove Road	2·37
III.	Harrow Weald, Hill House...	2·59	XIII.	Meggat Water, Cramilt Lodge	3·62
,,	Caversham, Rectory Road ...	2·67	,,	North Berwick Reservoir...	4·64
,,	Pitsford, Sedgebrook...	1·72	,,	Edinburgh, Royal Observaty.	5·67
,,	Woburn, Milton Bryant	2·01	XIV.	Maybole, Knockdon Farm ...	2·00
,,	Chatteris, The Priory	2·33	XV.	Ballachulish House	3·18
IV.	Elsenham, Gaunts End	3·26	,,	Campbeltown, Witchburn ..	2·69
,,	Colchester, Hill Ho., Lexden	2·11	,,	Holy Loch, Ardnadam	4·65
,,	Ipswich, Rookwood, Copdock	2·78	,,	Islay, Eallabus	1·32
,,	Blakeney	1·35	,,	Tiree, Cornaigmore	1·18
,,	Swaffham	2·02	XVI.	Dollar Academy	4·20
V.	Bishops Cannings	2·51	,,	Balquhidder, Stronvar..	4·13
,,	Wimborne, St. John's Hill ...	1·37	,,	Glenlyon, Meggernie Castle..	3·21
,,	Ashburton, Druid House.. ...	2·46	,,	Blair Atholl	3·76
,,	Cullompton	2·53	,,	Coupar Angus	3·89
,,	Lynmouth, Rock House	1·99	,,	Montrose, Sunnyside Asylum.	2·44
,,	Okehampton, Oaklands.. ...	3·22	XVII.	Alford, Lynturk Manse	2·18
,,	Hartland Abbey	1·80	,,	Fyvie Castle	1·86
,,	Probus, Lamellyn	1·36	,,	Keith Station ..	3·10
,,	North Cadbury Rectory	3·48	XVIII.	Rothiemurchus	3·65
VI.	Clifton, Pembroke Road	2·31	,,	Loch Quoich, Loan	9·40
,,	Ross, The Graig	2·45	,,	Drumnadrochit	2·16
,,	Shifnal, Hatton Grange	2·71	,,	Skye, Dunvegan	2·37
,,	Droitwich	1·68	,,	Lochmaddy, Bayhead	3·60
,,	Blockley, Upton Wold	2·17	,,	Glencarron Lodge	6·47
VII.	Market Overton	2·30	XIX.	Invershin	1·25
,,	Market Rasen	2·68	,,	Melvich	2·23
,,	Bawtry, Hesley Hall	2·17	,,	Loch Stack, Achfary	7·91
,,	Derby, Midland Railway	2·12	XX.	Dunmanway, The Rectory ..	2·71
,,	Buxton	4·14	,,	Glanmire, Lota Lodge	2·37
VIII.	Nantwich, Dorfold Hall	2·48	,,	Mitchelstown Castle	2·45
,,	Chatburn, Middlewood	5·72	,,	Darrynane Abbey	3·57
,,	Lancaster, Strathspey	4.06	,,	Clonmel, Bruce Villa	2·36
IX.	Langsett Moor, Up. Midhope	3·81	,,	Newmarket-on-Fergus, Fenloe	4·30
,,	Scarborough, Scalby	3·00	XXI.	Laragh, Glendalough	...
,,	Ingleby Greenhow	2·55	,,	Ballycumber, Moorock Lodge	2·76
,,	Mickleton	2·10	,,	Balbriggan, Ardgillan	3·26
X.	Bellingham, High Green Manor	3·17	XXII.	Ballynahinch Castle	4·45
,,	Ilderton, Lilburn Cottage ...	2·77	,,	Woodlawn	5·38
,,	Keswick, The Bank	2·67	,,	Westport, St. Helens ...	3·46
XI.	Llanfrechfa Grange	2·30	,,	Dugort, Slievemore Hotel ..	2·27
,,	Treherbert, Tyn-y-waun	5·92	,,	Mohill Rectory ..	4·86
,,	Carmarthen, The Friary	2·52	XXIII.	Enniskillen, Portora	...
,,	Fishguard Goodwick Station.	1·22	,,	Dartrey [Cootehill]	4·05
,,	Crickhowell, Tal-y-maes	4·00	,,	Warrenpoint, Manor House ..	3·17
,,	New Radnor, Ednol	2·60	,,	Banbridge, Milltown	3·51
,,	Birmingham WW., Tyrmynydd	4·79	,,	Belfast, Cave Hill Road	4·34
,,	Lake Vyrnwy	3·56	,,	Ballymena Harryville	2·61
,,	Llangynhafal, Plâs Draw	5·36	,,	Londonderry, Creggan Res...	4·02
,,	Dolgelly, Bryntirion	3·30	,,	Dunfanaghy, Horn Head ...	3·15
,,	Bettws-y-Coed, Tyn-y-bryn...	...	,,	Killybegs	2·69

THAMES VALLEY RAINFALL. —— AUGUST, 1915.

ALTITUDE SCALE

Below 250 feet	250 to 500 feet	500 to 1000 feet	Above 1000 feet

SCALE OF MILES
0 5 10 15 20

Symons's Meteorological Magazine.

Watershed of River Thames above Teddington, and River Lee above Feildes Weir.

Rainfall Stations reporting

Isohyetals

THE WEATHER OF AUGUST.

THE characteristic features of the weather of August were a mean temperature in excess of the normal, a marked deficiency of sunshine, and a large number of thunderstorms. The warmth and cloudiness were most pronounced in Scotland, where the mean temperature was 1°·5 above the normal and where the everage deficiency of sunshine amounted to slightly over one hour a day. In the south and south-west of England, including the Channel Islands, conditions did not depart much from the average.

The month opened with a low pressure area off the west of Ireland and high pressure systems to the south-west and north-east, and this type of pressure distribution with some slight modifications prevailed during the first half of the month. On the 2nd, when the low pressure system had moved south-eastward to the Cornish coast, rains were general over the whole of the United Kingdom, and heavy over Wales and the West Midlands, where many stations had over an inch and a half. The maximum falls reported were 2·32 in. at Llangynhafal, Denbigh; 2·05 in. at Bishops Castle; and 2·03 in. at Prestbury, Gloucestershire. At Biggar, Peebleshire, 1·75 in. fell in an hour during a thunderstorm. From the 3rd to the 15th the prevailing cyclonic type of weather was associated with local thunderstorms and heavy rains almost daily in all parts of the country. Few of the falls reported exceeded an inch and a half, but on the 11th 2·31 in. fell at Oldham, while on the 12th, at Carlisle, 2·85 in. fell, the greater part in an hour and a half. The highest temperatures of the whole month occurred on or about the 10th, but in no case reached 80° in the shade, the maxima reported being 79° at Raunds, Northamptonshire, and 77° at Greenwich, on the 10th.

On the 15th the succession of shallow depressions moving eastward over the North Sea terminated, and the weather steadily improved. Pressure during this period was in general highest off the west of Ireland, and the type markedly anti-cyclonic, although the central area of the anti-cyclone seldom covered the United Kingdom. Cool weather then prevailed till about the 23rd, the shade temperature rarely rising to 70° in any part of the country, but the last eight days were warm and sunny. In some inland situations a sharp ground frost was recorded on the 30th, and at North Cadbury Rectory the exposed minimum fell to 31°·5, the first ground frost reported in August during 18 years.

Rainfall was very irregularly distributed. More than the normal fell in six patches, namely the Thames estuary, the Fen district, the North Wales border, Fifeshire, the west of Ross, and the N.E. of Ireland. Less than half the average fell on the western coast of Scotland and in one or two isolated areas in the north and north-east, and in South Wales. In Ireland more than half the average fell everywhere. The wettest areas, with more than five inches, were in the West Highlands, the Firth of Forth, in the west of Co. Mayo, Lancashire, the Lake District, and the mountains of Central and South Wales. Less than 2 inches fell in the north and south-west coastal regions of Scotland, the south-east coast of Ireland, and generally in the east, south and south-west coastal regions of England.

In the Thames Valley the rainfall was extremely irregular and patchy, especially in the neighbourhood of London. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average, was as follows: England and Wales, 72; Scotland, 68; Ireland, 83; British Isles, 75.

Sunshine was deficient, the following amounts being reported: Camden Square, 148 hours; Totland Bay, 221 hours; Copdock, 168 hours; Sidmouth, 188 hours; Ashbourne, 145 hours; Southport, 147 hours; Hull, 112 hours; Haverfordwest, 195 hours; Paisley, 116 hours; Loch Stack, 109 hours; Swinton, 111 hours; Perth, 138 hours.

In London (Camden Square), the mean temperature was 62°·5, or 0°·2 above the average. Duration of rain, 22·3 hours. Evaporation, 1·75 inches.

Climatological Table for the British Empire, March, 1915.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	58·5	14	26·1	29	49·0	36·0	37·0	84	97·1	22·6	·86	12	7·3
Malta	79·3	21	46·0	11	61·5	52·3	...	86	139·0	...	1·50	6	1·5
Lagos	97·0	18, 19	73·4	25	90·6	79·3	75·2	70	157·2	72·0	2·72	5	6·3
Cape Town	96·9	8	54·4	13	79·5	60·7	56·9	64	...	...	1·82	3	2·7
Natal, Durban ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	85·6	11	44·7	22	76·1	55·0	55·1	80	...	42·2	2·64	9	3·2
Mauritius	88·0	15	70·0	8	84·1	73·5	72·0	81	...	63·1	10·19	17	6·1
Bloemfontein ...	91·1	12	40·6	21	82·2	53·9	47·5	50	..	...	1·17	4	4·0
Calcutta	95·5	23	63·9	9	89·1	69·0	66·8	70	...	53·7	4·19	9	5·1
Bombay	92·2	21	70·5	3	86·2	73·9	70·2	74	133·0	57·1	·69	3	2·4
Madras	97·4	26	68·8	11	90·3	74·2	72·9	77	160·5	68·2	·24	2	2·2
Colombo, Ceylon ...	92·9	21	72·2	19	89·9	74·5	73·9	78	165·0	66·8	5·07	12	4·3
Hongkong	79·8	6	54·2	17	69·2	61·0	58·2	78	...	...	2·64	11	8·0
Sydney	100·7	8	57·7	22	78·6	65·0	57·7	64	153·9	50·9	3·40	10	5·1
Melbourne	93·4	24	44·1	10	74·2	54·4	48·0	53	143·0	35·0	·25	6	5·3
Adelaide	97·3	11	49·4	22	79·2	57·9	47·5	38	152·5	37·5	·24	3	3·8
Perth	97·0	4	49·9	19	79·4	60·1	54·5	59	156·9	41·7	1·61	10	3·5
Coolgardie	97·2	5	48·0	19	82·5	57·3	50·5	48	154·4	43·8	·35	4	1·8
Hobart, Tasmania ...	85·8	24	43·3	29	66·2	50·4	44·7	63	136·1	34·1	2·43	12	6·6
Wellington	69·6	21	42·6	7	62·0	52·5	50·9	81	139·4	32·0	4·61	17	7·6
Auckland	74·0	16	49·0	9	67·7	55·8	55·3	80	142·0	45·0	7·27	17	5·4
Jamaica, Kingston ...	89·7	26	67·3	10	87·4	70·5	69·0	77	...	...	·58	5	3·8
Grenada	88·0	5†	71·0	27	85·0	74·3	...	70	136·0	...	1·02	4	2·0
Toronto	49·0	23, 24	10·6	30	37·5	22·4	21·3	76	116·7	7·0	·84	6	4·3
Fredericton	...	...	...	...	..	...	...	...	...	...	...	.	...
St. John, N.B. ...	52·0	25	9·0	27	35·5	21·8	19·0	67	...	...	·41	7	6·0
Alberta, Edmonton ...	62·3	21	7·8	3	41.5	21·1	...	74	119·0	1·0	·10	4	5·2
Victoria, B.C.	66·2	21	38·0	8	54·3	42·9	...	77	...	29·9	1·53	16	6·1

* also 14 and 17. † also 6 and 11.

Johannesburg.—Bright sunshine 269·7 hours.

Mauritius.—Mean temp. 0°·9, dew point 1°·1, and R ·90 in. above, averages. Mean hourly velocity of wind 0·5 miles above average.

Bloemfontein.—The driest March on record; very warm month.

COLOMBO, CEYLON.—Mean temp. 82°·2 or 0°·6 above, dew point 1°·0 above, and R 1·33 in. above, averages. TS on 5 days, distant T and L on 14 days.

HONGKONG.—Mean temp. 64°·9. Mean hourly velocity of wind 13·0 miles. Bright sunshine 115·7 hours.

Sydney.—Highest max. temp. for March on record.

Melbourne.—Mean temp. 0°·3 below, and R 1·97 in. below, averages.

Adelaide.—Very dry throughout the State.

Coolgardie.—Temp. 1°·7 below, and R ·25 in. below, averages.

Hobart.—Rainfall ·78 ins. above, and mean temp. 1°·3 below, averages.

Wellington.—Mean temp. 3°·2 below, and R 1·21 in. above, averages. Bright sunshine 136·7 hours.

Auckland.—Rainfall considerably above, and mean temp. below, averages.

JAMAICA, KINGSTON.—R one-third of the average.

ALBERTA, EDMONTON.—Sunny, dry and very warm; frosts on 28 nights.

Symons's
Meteorological Magazine.

No. 597. OCTOBER, 1915. Vol. L.

Colonel Michael Foster Ward.

1826—1915.

Colonel Michael Foster Ward, who died at his home, Upton Park, Slough, in his 90th year, served as an officer in the 90th Light Infantry, and after retiring from the Army became Colonel Commandant of the North Wilts Volunteers in 1864. He was one of the rainfall observers enlisted by Mr. Symons for the first volume of *British Rainfall*, published in 1862. From 1863 to 1868 he carried out at Castle House, Calne, Wiltshire, a series of observations designed to test the effect of size of aperture of rain gauges and height above ground on the amount of the catch of rain. Later the Rev. C. H. Griffith, of Strathfield Turgiss Rectory, continued these comparisons for many years. While engaged on these experiments Colonel Ward employed a clever local watchmaker named Rowdon to assist him in constructing various forms of rain gauge. Colonel Ward informed us that Rowdon suggested the use of a vertical rim above the sloping part of the funnel, and to the best of his belief, when Mr. Symons, then a very young man with coal black hair, visited Calne in 1865, he first saw the pattern now so familiar as the Snowdon rain gauge, which in Colonel Ward's opinion ought really to have been called the Rowdon rain gauge.

Colonel Ward co-operated with Mr. Symons in many interesting pieces of work. One of these was the discovery, in the Bodleian Library at Oxford, of the old Meteorological document, the M.S. of the Rev. William Merle's Journal of the Weather, 1337—1344, and its reproduction in facsimile in 1891. Colonel Ward spent much of his time in travelling on the Continent, and for a long time spent part of every year at his house in Partenkirchen, in Bavaria, and in 1885 he communicated to the Royal Meteorological Society an account of researches on a remarkable Alpine storm. Colonel Ward was at Partenkirchen when the war broke out in August, 1914, and although treated throughout with courtesy and consideration by the Bavarian authorities, he was not allowed to return to England until May, 1915. His journey home was protracted to the intolerable length of a month, but he reached Slough in safety, and wrote to us after his return with all the old interest in the Rainfall Organization and the kindliness of manner which was so characteristic of him at all times.

FLOODS IN THE NORTH-EAST OF SCOTLAND.

On the morning of Friday, September 24th, there was little on the Daily Weather Map to indicate that within 24 hours a considerable portion of the north-east of Scotland would be enveloped in a rainstorm associated with floods which have not been equalled in many districts since the famous Moray Floods of August, 1829. On that memorable occasion rain gauges were very sparsely distributed so that the maximum fall of 3·75 in. then recorded at Huntley Lodge, Aberdeenshire, in the 24 hours ending 5 a.m. of August 4th, 1829, was undoubtedly considerably less than what fell among the mountains to the west. Even after the lapse of nearly a century the representation of rainfall stations in this area leaves much to be desired. Through the kindness of Mr. A. Watt, M.A., Secretary to the Scottish Meteorological Society, we have been able to supplement the data received, so that the preparation of maps showing approximately the general distribution of rainfall on the 24th, 25th, and 26th, has been rendered possible. The remarkable rains in the north-east of Scotland appear to have been associated with the advance of a depression which as early as the 21st was approaching the West of Ireland. The Weather map of the 22nd shows no essential change in the pressure distribution, but heavy rain fell all day in Ireland, as much as two inches in some exposed western stations. By the morning of the 23rd the barometer was falling briskly in the west, and although the chart for the 24th shows no decided change in the pressure distribution, over an inch of rain fell in parts of the south of Scotland and over half an inch in the central Highlands. At 7 a.m. on Saturday, the 25th, a well marked cyclonic area with a minimum pressure of 29·5 in. lay over the south of Scotland and north of England, which during the day moved slowly northward along the Scottish coasts. The area of maximum rainfall was located on the shores of the Moray Firth near Inverness, the maximum falls reported being 4·07 in. at Fortrose; 3·78 in. at Nairn; 3·64 in. at Inverness; and 3·33 in. at Rothiermurchus. More than two inches fell in the north of Sutherland and Caithness, this wet zone being separated from the region of maximum rainfall by an area round the Dornoch Firth, in which less than an inch fell. By the morning of the 27th the low pressure system had travelled eastward to Denmark, the northerly gale subsiding to a fresh breeze. The rainfall for the 24 hours ending 9 a.m. of the 27th exceeded an inch in a considerable area between Nairn and Huntley, the maximum fall being 1·69 in. at the former station. The following shows the stations where more than four inches fell during the rainstorm which, although spread over three rain days, really occupied about 40 consecutive hours in most districts.

Station.	County.	24th. in.	25th. in.	26th. in.	Total. in.
Nairn	Nairn ..	·00	3·78	1·69	5·47
Fortrose	Ross ..	·09	4·07	·70	4·86
Elgin Manse	Elgin ..	·14	2·94	1·36	4·44
Gordon Castle ..	Banff ..	·11	2·65	1·48	4·24

The damage effected in the flood devastated zone was so great that details cannot be given within the limits of this notice. A few of the more noteworthy features of the visitation of wind and rain may be referred to. At Buckie Harbour on the shores of the Moray Firth the storm played havoc with the reclaimed ground covered by the extension works. The breakers striking the back of the new sea wall leapt 100 feet into the air and broke over in dense masses of spray. Many thousands of tons of material were carried seawards. At Nairn the river overflowed its banks and swept down an immense quantity of trees and shrubs and sheaves of corn. Sixteen bridges and culverts were carried away, and embankments and roadways seriously damaged. The Highland Railway was under water at many places following on more than 40 hours rainfall. Valuable agricultural land was inundated, crops destroyed, and towns isolated owing to the interruption of traffic. In the Grantown district the storm continued with unabated severity, whole fields were swept clear of corn, sheaves being carried down at certain points at the rate of 100 or 200 per hour. In Elgin the River Lossie at its highest point was only four inches below the high water mark of 1829. In the valley of the River Findhorn extensive flooding took place at Brodie and Moy, and passengers and mails from the east and west were motored to Forres, to join the south-going trains.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WET DAYS IN SEPTEMBER.

I HAVE taken rainfall readings here for the past 28 years. The rainfall of 2·56 in. on 24th September, 1915, is the greatest amount I have recorded in any one day. There was rain here from 1 p.m. to 6 p.m., but by far the largest portion, more than two inches, fell between 3 and 5 o'clock. The rain was very straight with scarcely a breath of S.E. wind, and no thunder.

At two other places within a mile of Aston House the rainfall for September 24th was 2·64 in. and 2·67 in. respectively.

JOHN DOVER.

Totland Bay, Isle of Wight, 1st October, 1915.

In this district yesterday after a fairly fine day slight rain commenced about 5.30 p.m., and from 9 p.m. and throughout the night heavy rain with a strong N.W. gale prevailed. At 9 a.m. this morning I measured 2·16 in. of rain. I have records since 1903, and this is the heaviest rainfall I have measured. The barometer yesterday morning was 29·7, and to-day 29·43.

JNO. W. HAYWARD.

Western House, Whitstable, September 29th, 1915.

Between 6 p.m. on September 28th, and 9 a.m. on the 29th, there was 2·16 in. of rain here. (This is precisely the amount reported in the *Times* to-day as having occurred at Whitstable). The wind backed from south through east to north. During cyclonic weather we seem more liable to heavy soaks with east winds than with any other winds.

G. WESTON.

The Vicarage, Bethersden, Ashford, Kent, October 1st, 1915.

September, 1915, has been remarkable for its few "rain" days —seven in all, and also for its heavy fall on the 28th, of 2·08 in., which fell between 6 p.m. and 9 a.m., and is so far as I can at present hear, the heaviest fall on that day in our neighbourhood, amounting to as nearly as possible one-thirteenth of our average annual rainfall at Detling, viz., 27 inches.

RICHARD COOKE.

The Croft. Detling, Maidstone, October 1st, 1915.

SNOW-DRIFT ON BEN NEVIS, AUGUST, 1915.

I have just seen a photograph of the snow-drift that remained on the summit of Ben Nevis on August 13th. It must have been unusually extensive for so late a period in the summer. The taker of the photograph informs me that the drift was many yards in length and three or four feet deep. Hailing from Boston, Mass., he was disinclined to believe that our little British hills could harbour snow in late summer, until he made the ascent of the Ben on the day in question, when he realized at least that the snow formed an excellent refrigerator for the bottle of refreshment with which he had toiled to the summit.

E. L. HAWKE.

Meteorological Office, S.W., September 8th, 1915.

ON WEATHER FORECASTS AND THE TEMPERATURE PREDICTIONS OF STRÖMBERG.

By Dr. Hans Pettersson.

(*Continued from p. 126.*)

In Figure 4 are reproduced four of the largest temperature-waves found by Dr. Strömberg in the temperature record of Upsala; the underlined numbers denote the length of each wave in days, the numbers within brackets the years from which the record has been analysed. The resemblance between the waves found in the first and the second half of the record is seen to be most pronounced, particularly for the wave of 29·60 days, which shows a remarkable persistence all through the very long record from which it has been extricated. This resemblance is obviously a most convincing proof of the actual existence of the waves. For if they were only an artificial result of the method of investigation, there is no reason whatever why the *same* waves should be found in both the two independent halves of the investigated records.

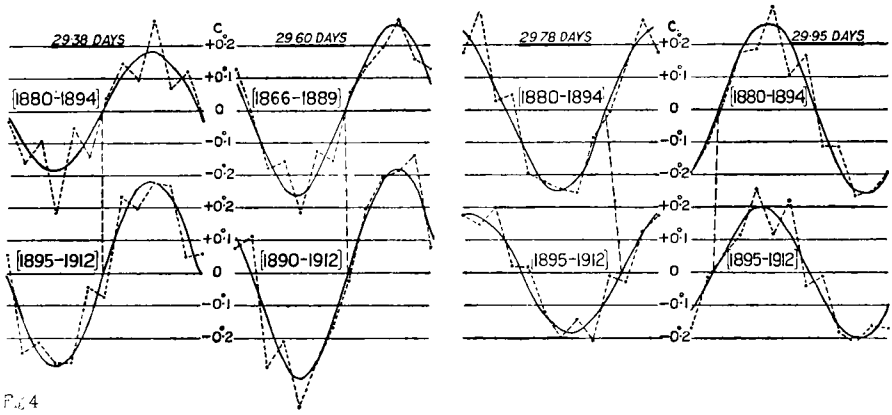


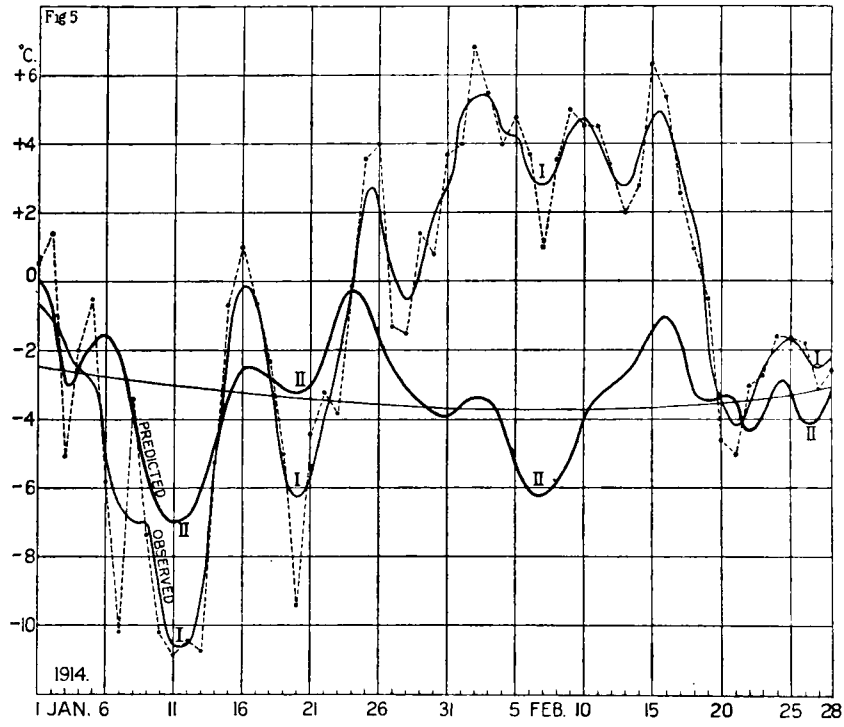
Fig. 4

It appears at present premature to try to give any physical interpretation of this remarkable phenomenon, viz., the occurrence of rythmical oscillations of sharply defined periods in the air-temperature. It is, however, certainly a curious coincidence that the group of four important waves reproduced here should agree so closely in length with one of the principal lunar periods, the synodical month (29·53 days).

It must be observed that the analysis in its present shape is far from complete. Only the temperature-waves of between 20 and 40 days have been systematically investigated, and but a few still shorter and longer waves have been extricated. Moreover the analysis has not been carried out on the raw curve of daily averages, but on a kind of smoothed curve, obtained from the former by plotting the mean from each set of three consecutive days, so that

instead of the average temperature for each day the mean is taken from that value and those of the preceding and the following day. In spite of this simplification (by which all periodicities shorter than three days are suppressed), the calculations have been extremely laborious, and occupied a whole staff of trained assistants for several months.

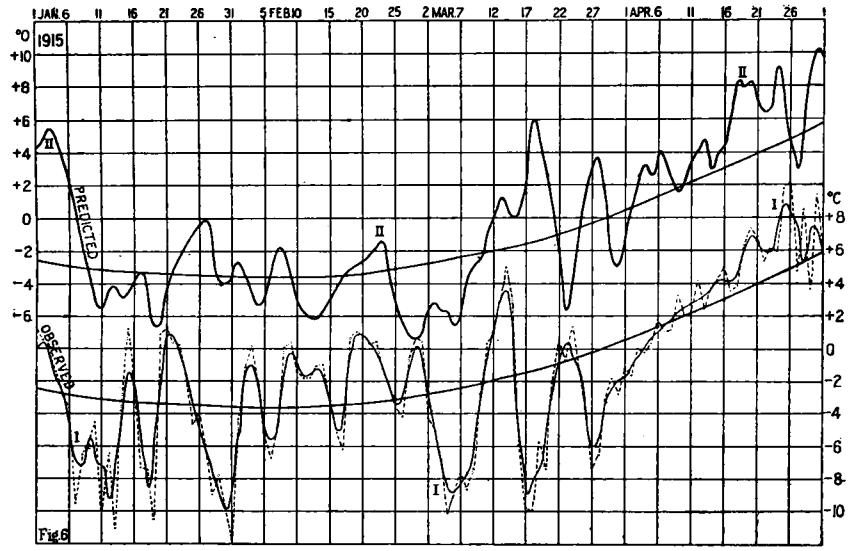
Dr. Strömberg has not hesitated to draw practical conclusions from his investigations. Already during the latter part of 1913 monthly temperature predictions were issued in the daily papers. Since then "Strömberg Calendars" have been published giving the predicted curves for the air-temperature of Stockholm, both



for 1914 and 1915, the latter also with curves for Lund and Gothenberg, whereas a separate calendar published in Norway gives a similar curve for Christiania. All these curves closely resemble that for Stockholm, so that the regularities found by Dr. Strömberg appear to be common to a large part of Scandinavia.

In a number of cases conspicuous breaks in the weather have been successfully foretold to the day. Taking a few instances from 1913; changes from warm to cold weather were duly predicted for June 6th; August 7th; October 20th; and December 12th: whereas changes in the opposite direction were correctly foretold for June 14th and July 12th. A very remarkable hit was

the accurate prediction of the most intense spell of cold weather during the following winter, which occurred between the 10th and the 13th of January, 1914. I have reproduced in Figure 5 the predicted (II.), and the observed (I.), curve, the latter obtained from the raw curve of observed daily averages (broken curve), by the smoothing-out process before mentioned. There is a striking *qualitative agreement* between prediction and observation during the first four weeks of the year. In both curves the same crests and hollows are visible, although they are considerably larger in reality than according to the predictions. From a quantitative point of view the predicted curve for February is a failure, as the temperatures actually recorded happened to be several degrees too high. But on the other hand there is an unmistakable



parallelism between the two curves, as perfectly *simultaneous* changes occur in both, although at different levels of temperature. The impression is exactly the same as when a large single roller breaks into a harbour and lifts on its back the system of smaller regular waves high above their normal level.

This example demonstrates at the same time both the merits and the demerits of Dr. Strömberg's predictions. At their best they show an unmistakable *conformity* with the curve of subsequent observations, so that much the same changes occur in both, although one of them may temporarily seem a couple of degrees below or above the other. On the other hand, it is only fair to admit that in a number of cases Dr. Strömberg's predictions have failed to foretell notable changes in the temperature, either completely or with a considerable exaggeration or underestimation

of their magnitude. As a further example we may take the predicted and observed curves for the first four months of 1915. (upper and lower curves in Figure 6). The slightly concave line is the annual temperature wave, *i.e.*, the gradual rise in the temperature from winter to summer as calculated from a very large number of years. Round this normal curve the daily average temperature is seen to fluctuate. In both curves there is a pronounced drop during the first decade of the year followed by variations of increasing amplitude. During the next month the agreement of details is not very good, but it is worthy of notice that the *general character* of both curves is much the same, the fluctuations of the temperature being middle-sized in February, very large in March, and quite small during April, but increasing in magnitude towards the end of that month. One should also

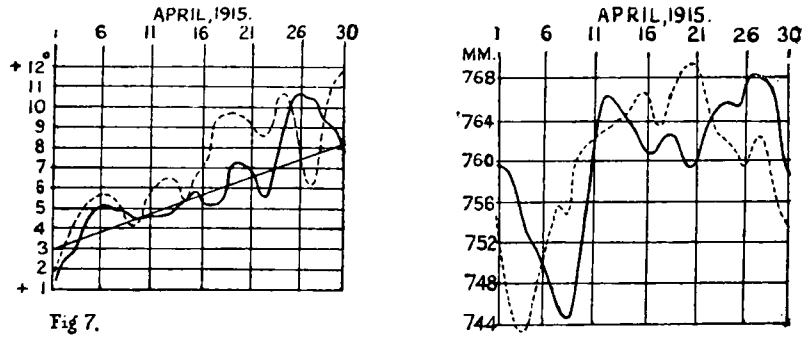


Fig 7.

observe that if the predicted curve had been displaced backwards by about four days from the 15th of March and onwards, the agreement during the following three weeks would have been striking, for not only would crests and troughs occur simultaneously in both curves, but even the length of the slopes are almost exactly alike.

The observed and predicted temperature curves for April are given separately in Fig. 7 together with similar curves for the barometric pressure (predicted curves full-drawn, observed curves broken). Dr. Strömberg has also tried to apply his methods to the pressure although hitherto not with quite as good results as for the air-temperature. The large minimum in the early part of the month is seen in both curves but here also the predicted curve has to be displaced by four or five days in order to give a good agreement.

However careful one must naturally be at the tracing of similar analogies, where a subjective element is almost unavoidable, still one must admit that there is an unmistakable *partial correctness* in the predictions. One has an impression that irregular influences will occasionally set in, displacing and even perturbing the temperature variations which would occur, if the regular elements were allowed to develop undisturbed. Now this is exactly what one might expect from the incomplete character of the analysis

and the probable existence of other influences on the air-temperature than those of a regular periodical character.

The results already gained appear to me so promising that an extension of Dr. Strömberg's investigations seems most desirable, both as regards the perfecting of the method itself and also an analysis of the temperature records from other localities, say that of London. The great expense required for this work, if carried out with the aid of human assistants, make it almost indispensable for Dr. Strömberg to employ a mechanical analysator like those used for tidal predictions. There is unfortunately no instrument of that kind available in Sweden.

Taking a parallel from practical life one might compare the work on weather predictions to that of prospecting for gold. The simple rules of the sailor and the farmer are like the largest nuggets found by the first untrained explorers. Then meteorological science steps in sifting the fine grains of gold, the less obvious regularities, from the "ore" of unaccountable changes in the weather. But the very finest gold dust, the invisible regularities and hidden periodicities can apparently only be extricated by more subtle methods like that of Dr. Strömberg. In its present shape his analysis can obviously not resolve the record completely, but only extricate some of its periodical elements, while a large part of the temperature variations must still be left as unforeseeable, the incalculable work of chance. Perhaps it may always be so, the weather predictions of the future never attaining but a partial correctness. But on the other hand it may also be possible that what is now considered freaks of the weather, irreducible irregularities in the temperature curve, will yield to a still more complete and refined method of analysis, so that "all the ore is converted into gold." If so we shall one day be able to predict the variations of the thermometer with the same almost infallible accuracy with which we can now foretell the rise and fall of the ocean's tides.

METEOROLOGY AT THE BRITISH ASSOCIATION.

THE eighty-fifth meeting of the British Association was held at Manchester under the Presidency of Professor Arthur Schuster, from September 7th to 11th, this being the first occasion on which the meeting lasted less than a complete week. The work of most of the Sections related to matters directly or indirectly connected with the war, and the reports in the Press were concerned almost entirely with educational and economic papers. There was a very poor attendance of Meteorologists and no Meteorological Luncheon was held. We were unfortunately unable to be present at the meeting, but Dr. F. G. Ogilvie, C.B., was good enough to send us an account of the proceedings. Professor Schuster's Presidential

Address broke from the usual custom of dealing in a technical manner with the President's own special department of science, and was devoted mainly to a discussion of the characteristics of the scientific mind. The title he chose for it being "The Common Aims of Science and Humanity." In Section A, Mr. F. J. W. Whipple dealt with the mechanism of Cyclones, the abstract of his paper being as follows :—

The distribution of pressure and temperature in cyclones in the Temperate Zone has been learned from the analysis of the records from the meteorographs carried by pilot balloons Up to a height of eight or nine kilometres the cyclone is composed of air cooler than its surroundings; at greater heights, *i.e.*, in the stratosphere, the cyclone contains comparatively warm air The lower limit of the stratosphere is depressed in the cyclone. This temperature distribution indicates that the air constituting the lower part of the cyclone has recently ascended, whereas the upper air has recently fallen, and accordingly the arrival of a cyclone is marked by an outflow of air at the bottom of the stratosphere and an inflow below. At the beginning of the present paper the amount of this displacement of air is estimated on the assumption that there is no direct exchange of heat and it is shown that the outflow is concentrated between the seventh and tenth kilometres, and is about 6·5 times the net loss of air as estimated by the fall of pressure at the earth's surface. It is pointed out that a cyclone may be regarded as a disturbance in the stream of air which flows from West to East in the Temperate Zone and the form of the isobars obtained by superimposing the permanent pressure distribution and the temporary cyclonic distribution is discussed. It is shown that when due allowance is made for the curvature and the progressive motion of these isobars, the gradient wind at certain heights is much less than it would have been if the curvature were inappreciable, so that at these heights the air supply from the rear to the front of the cyclone fails and the cyclone appears to move under the influence of suction applied at the base of the stratosphere. The explanation may be summarised as follows :—

If the flow of air at any level were entirely horizontal and along the isobars, and if changes of density were negligible, then the condition for continuity would require the velocity to be inversely proportional to the distance between the isobars, *i.e.*, the velocity would be directly proportional to the pressure gradient. This condition is not satisfied, however, in regions where the air-trajectories are curved to the left. The pressure has to produce the centripetal acceleration in the curved path in addition to overcoming the tendency to turn to the right, which is the feature of all horizontal motion in out hemisphere. Accordingly the actual velocity where the isobars are curved is less than it should be to secure continuity and maintian a stationary distribution of pressure. The effect of curvature in reducing the velocity is greatest at the heights where the winds are strongest, and therefore the suction effect is concentrated near the base of the stratosphere.

The general argument is supported by the analysis of two special cases.

In Section E, the President, Major H. G. Lyons, dealt with the Modern Science of Geography, and in the course of his address referred in the following terms to the importance of the study of

rainfall and the results obtained by the work of the British Rainfall Organization. In speaking of Physical Geography he said :—

Even here there is room for much more work of the detailed and critical type, which is not merely general and descriptive, but starts from the careful collection of data, proceeds to the critical discussion of them, and continues by a comparison of the results with those obtained in similar observations in other regions.

To take a single branch of Physical Geography, the study of Rivers; the amount of accurate material which has been adequately discussed is small. In our own country the rainfall of various river basins is well known through the efforts of a Meteorological Association, but the proportion of it which is removed by evaporation, and of that which passes into the soil, has only been very partially studied. Passing to the run-off, which is more easy to determine satisfactorily, the carefully measured discharge of streams and rivers are not nearly so numerous as they should be if the hydrography of the rivers is to be adequately discussed; for although the more important rivers have been gauged by the authorities responsible for them in many cases, the results have usually been filed, and the information which has been published is usual a final value, but without either the original data from which it has been deduced, or a full account given of the methods of measurement which have been employed. For the requirements of the authority concerned such a record is no doubt adequate, but the geographer requires the more detailed information if he is to co-ordinate satisfactorily the volume discharged with local rainfall, with changes in the rates of erosion or deposition, and the many other phenomena which make up the life-history of a river. Here, too, it is usually only the main stream which has been investigated; the tributaries still await a similar and even fuller study. A valuable contribution to work of this kind exists in the hydrographical study of the Medway and of the Exe, which has been undertaken by a Committee of the Royal Geographical Society during recent years, and this may serve as a guide to other workers; but, however welcome such a piece of work may be, I should much prefer to see the hydrography of a tributary of a river system worked out by a geographer as a piece of individual work, just as the geology or the botany or the zoology of a single restricted area is investigated by those whose interests are centred in these subjects.

In the same way we still know too little of the amounts of the dissolved and suspended matter which is carried down by our streams at various seasons of the year and in the different parts of their course. This class of investigation does not need very elaborate equipment, and may provide the opportunity for much useful study, which may be extended as information is increasingly acquired. In this way when numerous individual workers have studied the conditions prevailing in their own areas, and traced them through their seasonal and yearly variations, we shall possess a mass of valuable data with which we may undertake a revision of the results which have been arrived at in past years by various workers from such data as were then at their disposal.

RAINFALL TABLE FOR SEPTEMBER, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea.	RAINFALL OF MONTH.	
					Aver. 1875—1909.	1915.
		° ′	° ′	ft.	in.	in.
Camden Square	*London*	51 32	0 8	111	2·00	1·86
Tenterden	*Kent*	51 4	*0 41	190	2·25	3·39
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·58	3·18
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·60	3·78
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	1·98	2·68
Wellingborough(Swanspool)	*Northampton*	52 18	0 41	155	2·13	1·29
Shoeburyness	*Essex*	51 31	*0 48	13	1·70	2·23
Bury St. Edmunds(Westley)	*Suffolk*	52 15	*0 40	226	2·18	1·29
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·13	1·29
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	3·11	1·83
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·69	1·50
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·39	1·61
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·40	·81
Boston	*Lincolnshire*	52 58	0 1	11	2·07	1·24
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	1·84	·70
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·11	·85
Macclesfield	*Cheshire*	53 15	2 7	501	2·92	·71
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	3·09	·96
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	4·55	·93
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·11	1·37
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	2·05	1·35
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·00	1·69
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	11·28	2·08
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	3·61	1·10
Haverfordwest	*Pembroke*	51 48	4 58	90	3·91	3·10
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	3·89	2·05
Llandudno	*Carnarvon*	53 20	3 50	72	2·50	1·29
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	3·34	...
Marchmont House	*Berwick*	55 44	2 24	498	2·67	2·50
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	4·30	2·16
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	2·99	1·12
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	6·15	2·12
Mull (Quinish)	,,	56 34	6 13	35	5·20	1·40
Dundee(EasternNecropolis)	*Forfar*	56 28	2 57	199	2·34	1·19
Braemar	*Aberdeen*	57 0	3 24	1114	2·73	3·56
Aberdeen (Cranford)	,,	57 8	2 7	120	2·69	3·10
Gordon Castle	*Moray*	57 37	3 5	107	2·58	5·75
*FortAugustus(S.Benedict's)	*E. Inverness*	57 9	4 41	68	3·54	2·72
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	7·28	4·54
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·51	2·15
Wick	*Caithness*	58 26	3 6	77	2·57	3·39
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	3·79	2·58
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	3·19	1·81
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·16	1·93
Ennistymon House	*Clare*	52 57	9 18	37	4·22	2·14
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	2·78	1·62
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	2·93	2·14
Dublin(FitzWilliamSquare)	*Dublin*	53 21	6 14	54	2·06	·91
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·02	1·17
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	4·42	3·72
Cong (The Glebe)	,,	53 33	9 16	112	4·05	3.02
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·65	2·11
Seaforde	*Down*	54 19	5 50	180	3·25	1·38
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·49	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·39	1·83

* m.m

RAINFALL TABLE FOR SEPTEMBER, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875–1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875–1909. in.	STATION.
— ·14	93	1·51	28	5	17·92	22·17	+4·25	124	25·11	Camden Square
+1·14	151	2·14	28	9	18·32	22·55	+4·23	123	27·64	Tenterden
+ ·60	123	2·21	28	8	20·02	26·77	+6·75	134	30·48	Patching
+1·18	145	2·01	24	9	21·18	27·65	+6·47	131	31·87	Cadland
+ ·70	135	1·52	24	7	17·45	20·58	+3·13	118	24·58	Oxford
— ·84	61	·68	24	8	18·25	17·20	—1·05	94	25·20	Swanspool
+ ·53	131	1·95	28	9	13·17	16·27	+3·10	124	19·28	Shoeburyness
— ·89	59	·71	28	8	18·14	17·75	— ·39	98	25·40	Westley
— ·84	61	·70	28	11	16·33	21·45	+5·12	131	23·73	Geldeston
—1·28	59	·60	1	16	24·90	29·45	+4·55	118	38·27	Polapit Tamar
—1·19	56	·44	28	11	22·54	21·74	— ·80	96	33·54	Rousdon
— ·78	67	·73	1	7	21·12	21·94	+ ·82	104	29·81	Stroud
—1·59	66	·31	24	6	22·71	26·89	+4·18	118	32·41	Wolstaston
— ·83	60	·54	1	10	16·67	17·68	+1·01	106	23·35	Boston
—1·14	38	·51	24	4	17·54	17·12	— ·42	98	24·46	Hodsock Priory
—1·26	40	·39	24	9	19·25	22·19	+2·94	115	26·65	Mickleover
—2·21	24	·30	14	6	24·85	25·92	+1·07	104	34·73	Macclesfield
—2·13	31	·45	24	6	22·70	22·14	— ·56	98	32·70	Southport
—3·62	20	·50	24	9	42·14	37·75	—4·39	90	61·49	Arncliffe
— ·74	65	...	..	...	19·08	20·15	+1·07	105	26·87	Ribston Hall
— ·70	66	·43	24	9	18·57	19·35	+ ·78	104	26·42	Hull
— ·31	84	·47	24	12	19·65	16·79	—2·86	85	27·94	Newcastle
—9·20	18	·50	24	13	88·04	73·24	—14·80	83	129·48	Seathwaite
—2·51	30	·43	28	14	28·63	24·19	—4·44	84	42·28	Cardiff
— ·81	79	·60	24	13	30·96	31·38	+ ·42	101	46·81	Haverfordwest
—1·84	53	·33	1	16	30·92	30·41	— ·51	98	45·46	Gogerddan
—1·21	52	·34	1	11	20·55	22.27	+1·72	108	30·36	Llandudno
...	...	...	...	...	29·83	...	...	...	43·47	Cargen
— ·17	94	·81	24	12	23·89	21·52	—2·37	90	33·76	Marchmont
—2·14	50	·55	7	13	33·67	31·68	—1·99	94	49·77	Girvan
—1·87	37	·55	24	12	25·03	20·05	—4·98	80	35·97	Glasgow
—4·03	34	·46	13	13	46·21	43·76	—2·45	95	68·67	Inveraray
—3·80	27	·23	6	18	37·87	31·97	—5·90	84	56·57	Quinish
—1·15	51	·31	25	10	20·54	19·65	— ·89	96	28·64	Dundee
+ ·83	130	·88	25	12	24·16	28·08	+3·92	116	34·93	Braemar
+ ·41	115	·83	25	14	22·78	23·52	+ ·74	103	32·73	Aberdeen
+3·17	222	2·65	25	16	21·39	26·33	+4·94	123	30·34	Gordon Castle
— ·82	77	1·53	25	17	30·26	23·99	—6·27	79	44·53	Fort Augustus
—2·74	62	1·46	25	16	56·79	52·85	—3·94	93	83·93	Bendamph
— ·36	86	·53	25	11	22·41	...	...	...	31·90	Dunrobin Castle
+ ·82	132	...	..	...	20·68	17·01	—3·67	82	29·88	Wick
—1·21	68	·85	22	20	36·76	33·84	—2·92	92	54·81	Killarney
—1 38	57	·41	13	11	27·45	24·50	—2·95	89	39·57	Waterford
—1·23	61	·47	22	17	27·73	27·28	— ·45	98	39·43	Castle Lough
—2·08	51	·76	22	19	32·47	31·87	— ·60	98	46·52	Ennistymon
—1·16	58	·54	22	10	24·41	22·42	—1·99	92	34·99	Courtown Ho.
— ·79	73	·58	24	14	25·70	24·23	—1·47	94	35·92	Abbey Leix
—1·15	44	·21	24	16	19·89	20·19	+ ·30	102	27·68	Dublin
—1·85	39	·30	24	12	26·19	29·63	+3·44	113	36·15	Mullingar
— ·70	84	·83	22	19	35·74	34·62	—1·12	97	52·87	Enniscoe
—1·03	75	1·28	22	17	33·88	32·31	—1·57	95	48·90	Cong
—1·54	58	·94	22	18	30·14	31·51	+1·37	105	42·71	Markree
—1·87	42	·47	22	13	27·63	25·43	—2·20	92	38·91	Seaforde
...	...	...	...	...	26·32	...	...	...	37·56	Dundarave
—1·56	54	·60	24	12	28·05	27·40	— ·65	98	39·38	Omagh

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	2·31	XI.	Lligwy	1·54
,,	Ramsgate	2·34	,,	Douglas	1·15
,,	Hailsham	2·91	XII.	Stoneykirk, Ardwell House...	·53
,,	Totland Bay, Aston House...	3·75	,,	Carsphairn Shiel	2·47
,,	Stockbridge, Ashley..	3·16	,,	Beattock, Kinnelhead	1·82
,,	Grayshott	2·17	,,	Langholm, Drove Road	1·54
III.	Harrow Weald, Hill House...	1·84	XIII.	Meggat Water, Cramilt Lodge	1·42
,,	Caversham, Rectory Road ...	2·93	,,	North Berwick Reservoir.....	2·80
,,	Pitsford, Sedgebrook...	1·50	,,	Edinburgh, Royal Observaty.	2·73
,,	Woburn, Milton Bryant.....	1·73	XIV.	Maybole, Knockden Farm ...	1·39
,,	Chatteris, The Priory..... ...	1·00	XV.	Ballachulish House	2·14
IV.	Elsenham, Gaunts End	1·99	,,	Campbeltown, Witchburn ..	·88
,,	Colchester, Hill Ho., Lexden	1·61	,,	Holy Loch, Ardnadam.....	1·88
,,	Ipswich, Rookwood, Copdock	1·44	,,	Islay, Eallabus	1·92
,,	Blakeney	1·45	,,	Tiree, Cornaigmore	...
,,	Swaffham	1·07	XVI.	Dollar Academy	2·46
V.	Bishops Cannings	1·78	,,	Balquhidder, Stronvar.....	3·15
,,	Wimborne, St. John's Hill ...	2·40	,,	Glenlyon, Meggernie Castle..	2·07
,,	Ashburton, Druid House.. ...	1·49	,,	Blair Atholl	1·89
,,	Cullompton	·97	,,	Coupar Angus	1·77
,,	Lynmouth, Rock House	1·13	,,	Montrose, Sunnyside Asylum.	1·36
,,	Okehampton, Oaklands... ...	1·52	XVII.	Alford, Lynturk Manse	3·24
,,	Hartland Abbey.....	1·14	,,	Fyvie Castle	3·24
,,	Probus, Lamellyn.....	1·18	,,	Keith Station ..	5·94
,,	North Cadbury Rectory.....	2·92	XVIII.	Rothiemurchus	5·58
VI.	Clifton, Pembroke Road.....	1·64	,,	Loch Quoich, Loan	4·10
,,	Ross, The Graig	·86	,,	Drumnadrochit	4·14
,,	Shifnal, Hatton Grange.....	·86	,,	Skye, Dunvegan	3·11
,,	Droitwich	·90	,,	Lochmaddy, Bayhead	4·09
,,	Blockley, Upton Wold.....	·84	,,	Glencarron Lodge	4·62
VII.	Market Overton.....	1·13	XIX.	Invershin	2·36
,,	Market Rasen	·86	,,	Melvich	5·84
,,	Bawtry, Hesley Hall	·61	,,	Loch Stack, Achfary	5·97
,,	Derby, Midland Railway.....	·89	XX.	Dunmanway, The Rectory ..	5·10
,,	Buxton	·88	,,	Glanmire, Lota Lodge.....	2·10
VIII.	Nantwich, Dorfold Hall	·55	,,	Mitchelstown Castle.....	1·98
,,	Chatburn, Middlewood	...	,,	Darrynane Abbey.....	5·85
,,	Lancaster, Strathspey	·76	,,	Clonmel, Bruce Villa	1·87
IX.	Langsett Moor, Up. Midhope	·72	,,	Newmarket-on-Fergus, Fenloe	1·79
,,	Scarborough, Scalby	3·05	XXI.	Laragh, Glendalough	1·97
,,	Ingleby Greenhow	1·70	,,	Ballycumber, Moorock Lodge	1·63
,,	Mickleton	·90	,,	Balbriggan, Ardgillan	·65
X.	Bellingham, High Green Manor	4·33	XXII.	Ballynahinch Castle.....	4·48
,,	Ilderton, Lilburn Cottage ...	1·94	,,	Woodlawn	2·03
,,	Keswick, The Bank.....	·96	,,	Westport, St. Helens	1·93
XI.	Llanfrechfa Grange	1·00	,,	Dugort, Slievemore Hotel ...	3·45
,,	Treherbert, Tyn-y-waun	2·39	,,	Mohill Rectory ..	1·68
,,	Carmarthen, The Friary	1·79	XXIII.	Enniskillen, Portora.....	1·75
,,	Fishguard Goodwick Station.	2·17	,,	Dartrey [Cootehill]	1·90
,,	Crickhowell, Tal-y-maes.....	1·20	,,	Warrenpoint, Manor House ..	1·01
,,	New Radnor, Ednol	1·45	,,	Banbridge, Milltown	·95
,,	Birmingham WW., Tyrmynydd	·87	,,	Belfast, Cave Hill Road	1·67
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	1·02
,,	Llangynhafal, Plâs Draw.....	1·14	,,	Londonderry, Creggan Res...	1·49
,,	Dolgelly, Bryntirion.....	2·24	,,	Dunfanaghy, Horn Head ...	2·48
,,	Bettws-y-Coed, Tyn-y-bryn...	2·69	,,	Killybegs	3·33

THAMES VALLEY RAINFALL —— SEPTEMBER, 1915.

Symons's Meteorological Magazine

Watershed of River Thames above Teddington, and River Lee above Feildes Weir

Rainfall Stations reporting Isohyetals

THE WEATHER OF SEPTEMBER.

DURING the early days of September very cold weather for the season prevailed with day maxima in many instances below 60°, while minima under 35° were not uncommon. Northerly and north-westerly winds prevailed, Great Britain being under the influence of low pressure systems over the North Sea, while areas of high barometric pressure were located to the N. and S.W. of our Islands. On the 4th at West Linton the shade thermometer fell to 26°, and on the grass to 24°, while ground frosts were common over a very extensive region. Thunderstorms were experienced very generally on the 1st and 2nd, and more locally on the 3rd. Showers during this time were common in most districts. From about the 3rd to the 23rd the general distribution of pressure was on the whole anti-cyclonic, although after the middle of the month the eastern portions of the country, particularly Scotland, had rather more than the average rainfall. The weather, speaking generally, was extremely dry with many warm days, long cloudless periods, and a large daily range of temperature. In the south of England cool weather prevailed till about the 12th. Elsewhere it was rather warm. On the 8th the temperature at Manchester rose to 76°, and at Gordon Castle in Banffshire to 77°, which was also reached at Nairn on the 10th. The highest temperatures were noted after the 15th, reaching 80° at Camden Square on the 16th and 17th, and also at Raunds, Northamptonshire and at Tottenham on the latter day. On the other hand the maximum at Harrogate on the 17th was only 68°. Several low minima were recorded on various dates. At Balmoral 31° was noted on the 12th in the screen, a similar value on the grass occurring at Greenwich on the 19th.

On the 23rd the long partial drought over the southern counties terminated. In London (Camden Square), in the 39 days ending the 23rd, only ·30 in. of rain fell, the total duration of rain being only six hours. After the 23rd some remarkably heavy rains occurred in various localities. On the 24th heavy rain fell in the West of Ireland, the south of Scotland and in some other places, notably in the Isle of Wight and adjacent coastal areas, where at Totland Bay 2·56 in. fell. On the 25th and 26th the north-east of Scotland was devastated by a northerly gale accompanied by a rainstorm and floods of almost unexampled intensity (see note p. 138), and on the 28th a heavy rainfall yielded maximum falls exceeding 2·50 in. in many places situated in the S.E. counties of England, particularly Kent.

Under one inch of rain fell during the month over the extreme south-west of Scotland, the east of Ireland, the east and north of Wales and central England, N.W. of a line from Lincoln to Gloucester, and including most of Lancashire and the northern Pennines. In parts of Shropshire and Cheshire less than ·50 in. fell. More than five inches fell in the north of Scotland, Ireland W. and S.W., and in Snowdonia; while parts of the north and north-east of Scotland had more than six inches. A remarkable feature of the month was the fact that the rainfall along the west coast of Great Britain was much lower than in the east.

In the Thames Valley less than an inch fell in the N.W. only. The wettest part was in the centre stretching south from Watlington, Oxford, with over 3 inches, and reaching a maximum of 4·3 in. at Oakley, S.W. of Basingstoke. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was as follows: England and Wales, 59; Scotland, 75; Ireland, 60; British Isles, 64.

Sunshine was abundant in the south and west, scanty in the north and east. The following amounts were reported: Camden Square, 161 hours; Totland Bay, 194 hours; Copdock, 165 hours; Sidmouth, 196 hours; Weymouth, 200 hours; Felsted, 182 hours; Southport, 184 hours; Hull, 117 hours; Haverfordwest, 127 hours; Paisley, 133 hours; Loch Stack, 118 hours; Perth, 125 hours; Swinton, 128 hours.

In London (Camden Square), the mean temperature was 58°·3, or 0°·6 above the average. Duration of rain, 20·0 hours. Evaporation, 1·61 in.

Climatological Table for the British Empire, April, 1915.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	72·8	30	31·2	1	57·6	39·1	39·5	73	115·6	25·2	1·13	9	5·3
Malta	71·1	9	47·0	12	63·3	54·7	...	85	141·0	...	2·87	6	1·6
Lagos	93·3	18	72·3	20	89·7	77·3	75·6	74	158·0	70·0	7·04	10	7·5
Cape Town	83·7	20	46·0	26	69·7	52·3	53·2	75	...	...	2·81	9	5·7
Natal, Durban ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	78·7	10	35·3	25	70·8	51·1	46·3	70	...	35·0	·32	3	2·2
Mauritius	85·6	7	64·8	27	83·2	71·1	70·4	81	...	59·7	2·81	22	4·7
Bloemfontein	83·7	9	33·9	25	74·3	44·0	41·0	56	..	...	·15	4	2·9
Calcutta...	103·4	17	68·9	24	97·0	76·6	70·8	64	...	63·9	1·57	2	2·3
Bombay...	93·0	14	75·6	9	90·1	78·6	73·8	72	138·0	61·1	·06	2	3·1
Madras	99·8	2	73·2	8	93·5	77·5	75·1	76	163·7	70·4	·52	3	1·6
Colombo, Ceylon ...	92·5	14	71·5	11	90·7	75·5	76·7	82	158·6	69·4	4·74	16	4·5
Hongkong	84·0	19	62·8	8	78·7	71·3	69·9	84	...	...	1·80	11	8·6
Sydney	82·7	18	50·2	25	70·3	58·3	57·1	78	133·2	42·6	10 56	17	5·4
Melbourne	81·0	8	40·0	25	67·2	51·6	48·4	66	133·0	29·7	2·31	12	5·7
Adelaide	86·8	16	45·2	27	72·0	53·7	49·8	62	138·8	32·3	2·42	10	4·7
Perth	89·9	3	53·0	7	77·8	59·8	53·8	58	154·2	45·0	1·44	6	4·5
Coolgardie	87·4	14	47·0	18	76·1	54·3	49·2	54	155·8	41·0	·58	5	3·2
Hobart, Tasmania ..	75·9	16	40·0	25	62·9	48·7	44·6	61	129·0	31·0	2·40	11	5·9
Wellington ...	70·2	19	36·0	24	61·8	49·0	47·0	73	124·6	21·2	·68	8	5·7
Auckland	71·0	15	42·5	24	64·9	52·9	52·9	82	137·0	39·0	4·45	16	5·1
Jamaica, Kingston ...	90·4	7	67·1	30	86·6	70·7	68·5	77	...	...	5·08	9	4·2
Grenada	88·0	22	71·0	24	83·6	75·1	...	77	135·0	...	3·93	14	3·5
Toronto	83·7	26	26·5	3	59·3	40·3	37·8	68	133·7	23·8	1·29	14	4·9
Fredericton	64·0	12, 20	21·0	6	49·5	32·2	33·4	76	...	...	3·37	13	6·8
St. John, N.B. ...	64·3	20	24·4	5	45·2	33·7	30·0	70	...	...	4·08	18	7·4
Alberta, Edmonton ...	79·2	16, 29	24·1	22	62·5	36·0	...	54	132·0	17·0	1·11	9	5·0
Victoria, B.C.	67·1	16	38·8	30	58·4	43·9	44·0	78	145·0	28·0	·57	9	4·9

Johannesburg—Bright sunshine, 288·2 hours.

Mauritius—Mean temp. 1°·3 above, dew point 2°·0 above, and R 1·17 in. below, averages. Mean hourly velocity of wind 2·4 miles below average.

COLOMBO, CEYLON—Mean temp. 83°·1 or 0°·3 above, dew point 1°·9 above, and R 2·57 in. below, averages. TS on 4 days, distant T and L on 25 days.

HONGKONG—Mean temp. 74·6. Mean hourly velocity of wind 13·6 miles. Bright sunshine 126·4 hours.

Melbourne—Mean temp 0°·2 below and R ·01 in. above, averages.

Adelaide—Mean temp 1°·1 below and R ·56 in. above, averages.

Coolgardie—Temp. 0°·2 above and R slightly below, averages.

Hobart—Temp. 0°·6 above average.

Wellington—Mean temp. 1°·5 below and R 3·34 in. below, averages. Bright sunshine 188·6 hours. Frost on grass on 6 days.

Auckland—Mean temp. below and R 1·40 in. above, averages. On the 2nd 2·43 in. of rain fell.

ALBERTA, EDMONTON—Warm and sunny. R above average. Frost on 9 nights. TSS on 2 days. Fog on one day. Three gales.

Symons's
Meteorological Magazine.

No. 598. NOVEMBER, 1915. Vol. L.

THE WORK OF THE METEOROLOGICAL OFFICE.

The war, we learn from the latest Annual Report*, has affected the work of the Meteorological Office in many ways. Permission to enlist on the terms laid down for the Civil Service was granted to seven members of the staff, and several others joined the Army under other conditions. A number of applications to join H.M. Forces had to be declined, so that the Meteorological requirements of the Admiralty and the War Office might not be interfered with owing to the loss of so many members of the staff. Steps have been taken to augment largely the staff of women clerks, and some difficulty has been experienced in keeping the routine work of the office up to date "because so much of the clerical work is of a special character, requiring long practice and experience."

A special Temporary Staff for Meteorological Field Service (Forecast Division), has been instituted under the direction of Major H. G. Lyons, R.E., in connection with which numerous offers of assistance have been accepted, amongst many others being Mr. C. J. P. Cave, M.A., and Mr. E. L. Hawke, B.A.

The scientific labours of the Meteorological Office grow in volume and importance every year, and in spite of the difficulties referred to above, a fine record of accomplished work is given in the Report. The introduction of the new units of measurement has continued to make progress, but it is remarked that "the adoption of the millimetre instead of the inch for the measurement of rainfall . . . . . has met with less appreciation." Experiments at the National Physical Laboratory have led to the discovery of an error in the method of correcting barometers of the Kew pattern.

Reference is made to the approaching publication of the representation of the meteorology of the Globe for 1911, by observations

*Tenth Annual Report of the Meteorological Committee to the Lords Commissioners of His Majesty's Treasury for the year ended 31st March, 1915. London, H.M. Stationery Office. Size 9½ × 6, pp. 93 and plates. Price 5½d.

from two stations in each ten degrees square of latitude and longitude, which is now passing through the press under the title of the "Réseau Mondial, 1911," in which pressure is given in millibars and temperature in centigrade degrees absolute.

A request was received early in 1914, through the Foreign Office and the Board of Agriculture and Fisheries, for a statement of the legislative enactments and the administrative processes by which provision is made in this country for meteorology, with special reference to Agriculture. The reply of the Meteorological Committee to the French Ambassador is reproduced as an appendix to the report, and gives an interesting history of the Meteorological Office since its foundation, and of the growth of the various branches of the service. It is remarked that "it is really an open question whether the responsibility for the application of meteorology to agriculture belongs to the Meteorological Office or to the Board of Agriculture and Fisheries in England and the corresponding departments in Scotland and Ireland. The traditional attitude of the Meteorological Office is that it collects and digests meteorological information which the agriculturist can apply if he wishes; and from that point of view a statement is made of the data which could be utilised in this connection, viz., the "Forecasts," and the "Statistics," including the Weekly and Monthly Weather Reports. It is pointed out that "in actual practice these provisions are very little used by agriculturists." Many persons are willing to receive forecasts by telegraph, but are unwilling to pay for the telegrams; it is entirely contrary to the instinct of the British race to pay for anything until its value has been made undeniably clear, so that the farmer and the Government are both waiting for the utility of the forecasts to be demonstrated beyond cavil. Yet this can only be done by trial and nobody has yet been found who is willing to pay the cost of an adequate trial on a large scale. In this connection it is stated that when "the application of meteorology to agriculture is considered, so far as the Meteorological Office is concerned, anything which is dependent upon the detailed study of the distribution of rainfall is not necessarily included," as the important subject of rainfall in the British Isles is still the care of a private body, the British Rainfall Organization. In other parts of the Report Sir Napier Shaw refers to the co-operation which exists between the Meteorological Office and the British Rainfall Organization, the most prominent features of which are the supply of detailed maps of monthly rainfall by the Organization for publication in the Monthly Weather Report, and the help given by the Meteorological Office towards publishing the annual totals of rainfall in millimetres as well as in inches in Part III. of *British Rainfall, 1914*. Summing up Sir Napier Shaw says "In fine it may be said that at present the Meteorological Office is more concerned with the means for

organizing *la météorologie agricole* on a satisfactory basis, than with any organization actually in operation."

Appendix 3 refers to climatological stations and Local Authorities. It is submitted that the Local Authorities should give serious consideration to the question of an adequate record of the weather. It is recommended that every parish ought to have its rain gauge, and every district Council a fully equipped climatological station. Out of 500 observatories and stations which contribute observations to the Office for the benefit of the public, only 36 are maintained or subsidized out of Office funds.

Appendix 4 on a "Central Observatory for the Investigation of the Upper Air," gives the present position of this branch of the Service, and a proposal for the establishment of an adequately equipped station. Since 1905 a sum of £450 has been assigned annually to this work, and the new scheme is estimated to cost from £1050 to £1450. At present Mr. W. H. Dines receives an honorarium of £200 per annum, and the proposal is that "having regard to the high qualifications necessary," this should be increased to from £500 to £650 a year. The new station acquired by Mr. Dines at Benson, 3 miles from Wallingford and about 12 miles distant from Oxford and Henley, has many features to recommend it. We are sure that it will come as a surprise to many of our readers that the unique services of Mr. W. H. Dines to Upper Air research have hitherto been so poorly recognized, but it has been one of the special merits of British observational Meteorologists from the days of Luke Howard onwards, that their work has been done with a view to the advancement of knowledge, rather than to their own profit. The reports of the Superintendents of the Marine Division, the Forecast and Gale Warning Division, the Climatological and Statistics Division, the Instruments Division, and of the various Observatories also find a place. As regards gales, the analysis shows that for the whole country, 84 per cent. of the warnings were justified by the occurrence of winds of gale force, the highest percentage, 100, was recorded in Scotland E. and England N.E., and the lowest, 70 per cent., in England S.E., and 75 per cent. in Scotland N.E. and Ireland S. The preparation of replies to inquiries from public authorities and private persons, based upon information contained in the files of the Office, forms an increasingly important part of its work. The total number of inquiries answered in the year 1914-15 amounted to 816, being 235 below that of the year previous and the lowest since 1910-11.

Many enquiries as to Upper Air and other meteorological conditions from the scientific staff of the Royal Aircraft Factory, have been dealt with and enquiries were also received from the Royal Naval Airship Squadron while this was stationed at Farnborough.

A summary by Sir Napier Shaw shows the progress and consolidation of the work of the Meteorological Office during the

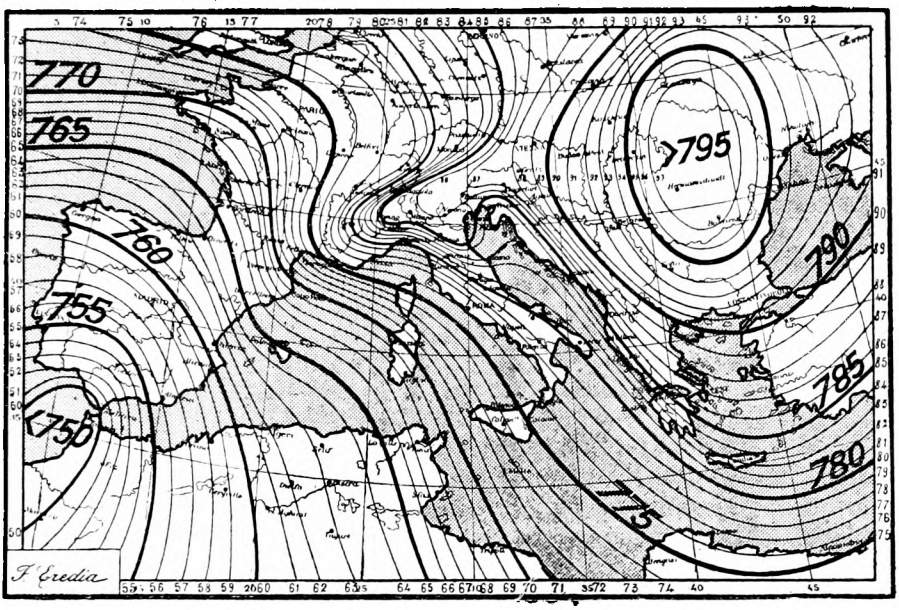
second quinquennial period of the appointment of the Meteorological Committee. These years have been marked chiefly by the co-ordination and extension of the meteorological and geophysical work within the administration of the Office. At the commencement of the period the physical observatories at Kew, and Eskdalemuir, came under the administration of the Office. The Falmouth Observatory has come under the direct control of the Committee because the Royal Cornwall Polytechnic Society was no longer able to maintain it, but was prepared to allow the use of the building rent free. At the request of the Army Council an observatory and Branch Office for the assistance of air craft pilots has been established in the Royal Aircraft Factory at South Farnborough. Subventions of long standing to Glasgow University and to Stonyhurst College, in aid of the maintenance of meteorological observations of the Kew type, have been withdrawn. A branch meteorological office has been established in Edinburgh under an arrangement with the Scottish Meteorological Society, who receive a subvention of £350 a year. On account of this consolidation the monthly weather report now presents a full summary of the climatological observations made by public authorities or private persons in the British Isles. The importance of the consolidation for the efficiency of the Office is dwelt upon at considerable length, especially as regards the relations between the Admiralty and the Meteorological Office.

But in the present time of emergency it is the organization of the Forecast Division which chiefly calls for remark. A number of provisions arranged simply with a view to the efficiency of the Office as a public institution have proved to be indispensable since the outbreak of war, in order to meet the requirements of the Admiralty. All the observatories had been newly organized to take part in the daily weather service and thereby to become cognizant of the problems which they are intended to elucidate, and they have thereby become available for supplying information to the Office at any time, day or night. The other reporting stations had also been so organized in conjunction with the observatories, that the Forecast Division has not failed to meet promptly and efficiently whatever wishes the Admiralty had expressed for information as to the weather over any part of the British Isles and neighbouring seas, for the use of the Navy, the Air Department, or the officials at headquarters. . . . . So far as the Office staff is concerned, the net result up to now has been that what was originally provided for the service of the general public has been found necessary and has, therefore, been "commandeered" by the Admiralty for the public service. The work has been carried on without any undue stress upon the staff, but at the sacrifice of certain "appropriations in aid," in consequence of the suspension of the supply of information to the public."

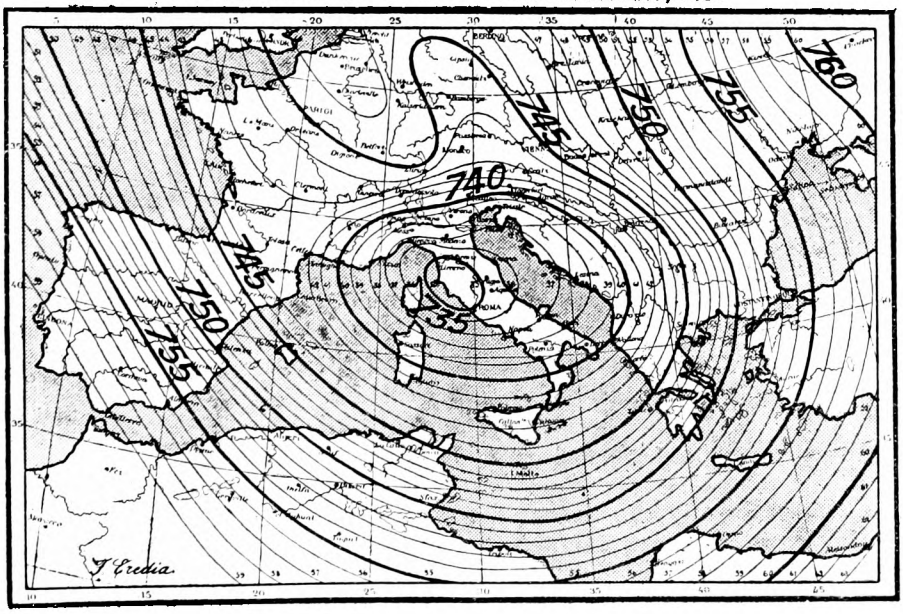
MEDITERRANEAN PRESSURE TYPES.

We have received from Dr. F. Eredia of the Central Italian Meteorological Office the two interesting post cards reproduced below illustrating two extreme types of pressure distribution in the south of Europe. The figures are millimetres.

REMARKABLE ANTICYCLONE OF 24TH JANUARY, 1907.



REMARKABLE CYCLONE OF 23RD JANUARY, 1915.



INTERNATIONAL BALLOON ASCENTS.

By W. H. DINES, F.R.S.

The last two sets of international balloon ascents which were published before the war and received in England are given below. The work done in 1913 and the first half of 1914 is not available.

May 2nd, 1912.

Starting Point.	Country.	A (H_c.) miles.	B (T_c.) ° F.	C miles.	D ° F.	E miles	F
Manchester	England ..	7·5	—68	14·5	—53	39	E.
Pyrton Hill	„ ..	7·0	—73	10·0	—59	25	S.E.
Brussels	Belgium ..	6·6	—80	13·4	—46	26	S.S.W.
Lindenberg.....	Germany..	6·1	—71	8·3	—68	21	S.S.W.
Paris	France....	7·1	—77	10·7	—66	44	S.
Strassburg	Germany..	6·3	—60	8·2	—58	24	W. by S.
Munich	„ ..	6·2	—59	6·9	—58	10	W.N.W.
Vienna.....	Austria ..	6·5	—68	7·0	—70	16	S.E.
Pavia	Italy.....	6·3	—70	13·3	—47?	9	W.
Nizhni Olchedaeff	Russia	5·6	—58	6·9	—52	57	S.E.
Batavia	E. Indies..	..	..	9·9	—113	41	S.W.

The very low temperature at Batavia, 5° S. latitude, is again remarkable. There was not much air motion over Europe, and an unusual number of balloons fell to the westward of their starting place. Barometric pressure was a little above the average at most stations.

June 6th, 1912.

Starting Point.	Country.	A (H_c) miles	B (T_c) ° F.	C miles.	D ° F.	E miles.	F
Limerick.....	Ireland....	5·6	—60	8·4	?	16	S.
Manchester.....	England ..	5·9	—58	7·7	—41	26	E.S.E.
Hamburg.....	Germany..	6·5	—60	6·9	—58	62	N.E.
Paris	France....	6·6	—67	9·7	—58	75	N.E.
Strassburg	Germany..	7·1	—71	9·9	—58	56	N.E.
Munich	„ ..	7·2	—68	8·4	—66	39	N.E.
Batavia	E. Indies..	..	..	10·1	—105	77	W.

A Height in miles of commencement of isothermal column.
B Temperature, F°., at bottom of column.
C Greatest height of reliable record in miles.
D Temperature, F°., at greatest height.
E Distance in miles of point where balloon fell
F Bearing of falling point from starting point

Over Europe the pressure was lower than usual, especially in the west. The low temperature at great heights near the equator is again shown.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

UNPRECEDENTED RAINS AND CYCLONE TRACKS.

THE *Monthly Weather Report* of the Meteorological Office for September, 1915, shows that the movement of the centre of the low pressure system which accompanied the great rains of September 25th—26th, in the north-east of Scotland, bore a singularly close resemblance to the tracks of the depressions of August 24th—26th, 1905, and August 25th—26th, 1912, associated with unprecedented rains in Ireland and in East Anglia. On each occasion, as was remarked at the time (see *British Rainfall, 1905*, p. [III], and *British Rainfall, 1912*, p. 28), the centre travelled nearly due north along an east coast and then turned abruptly to the east, the area of heaviest rain being on the left of the track not far distant from the point of deviation. The centre of the depression in each case moved over the sea and the maximum rain area lay near the east coast, the conditions being favourable for north-east wind, backing to north. The remarkable similarity of the atmospheric conditions during three of the most notable east-coast rains ever put upon record, occurring approximately at the same season respectively in Ireland, England and Scotland, appears to be extremely suggestive. CARLE SALTER.

62, Camden Square, N.W., November 4th, 1915.

DIURNAL NATURE OF AUGUST STORMS.

DURING the first half of August there prevailed just that peculiar adjustment in the distribution of atmospheric pressure which is required in order that the diurnal swing of the weather elements may assume special prominence. Whilst the nights during this period were invariably fine and quiet, the days were no less marked by a persistent series of thunderstorms of varying degrees of intensity. In London thunder showers or storms occurred on the 3rd, 4th, 10th, and on five consecutive days from the 12th to 16th, all of them between 11 a.m. and 8 p.m. Some of these storms, notably that of the 12th, were rather severe and protracted, while the massive and, towards evening, richly coloured cloud banks were, in some instances, superbly grand and beautiful. Storms of this pronouncedly diurnal type, engendered by the heat of the sun during the daytime, are very common during spells of cool, unsettled weather, and afford a striking contrast with the more violent and protracted hot weather type of thunderstorm which often develops at nightfall (as on May 6th this year).

August 31st, 1915. L. C. W. BONACINA.

GREENWICH WINTERS.

Let us understand by severe winters, those with mean temperature under 38°·3, *i.e.*, more than 1° under average; mild winters having mean temperature over 40°·3.

Of the 74 winters since that of 1842 (*i.e.*, 1841-42), 21 were severe, 30 mild. The severe are thus about 28 per cent. of the whole. Since 1895, however, only one winter out of 20 was severe, viz., 1907. In the period 1842-1895, the 20 severe winters form 37 per cent. of the whole. This recent continued mildness may, in minor part, be due to the extension of London towards Greenwich, but it seems to be a general experience in the country. Rothesay, I find, has had two severe winters since 1895. Consider all groups of five contiguous winters, 70 in number. How many are severe in each? We find no cases of five or four severe. Of three severe there are eight cases; of two severe there are twenty-six cases; of one severe there are twenty-three cases; of none severe there are thirteen cases; total, 70 cases.

The eight groups with three severe were all in 1879-93, *i.e.*, the first of them, was centred in 1879. The thirteen with no severe winter were all but two, viz., 1850, and 1851, since 1898.

We might treat winter rainfall similarly, calling a winter wet which had more than one inch over the average, and one dry which had more than one inch under the average. It appears, that of 14 wet winters, 7 were mild, and only two severe. Of 23 dry winters, seven were mild and eight severe. Thus, while a wet winter is likely to be mild, a dry winter may be indifferently mild or severe. A.B.M.

LUNAR RAINBOW.

Since toiling through the graphic description in "Wilhelm Tell" of the Rütli "Verschworung" as a schoolboy in the early sixties, it has been my ambition to witness such a display of a lunar rainbow as forms a climax to that famous scene. Only this morning was my wish fully gratified. At 5.20 a.m. to-day there was an easterly rain squall, the western sky remaining very clear so that the moon, within 20 hours of the full, was brilliant, although only about 10° from the horizon. The rainbow was, consequently, of exceptional size, the base being probably over 100° long, from N.E. to S.S.E. The vertex, however, was not visible (at about 50°), some 20° or 25° of arc wanting. The southern arc was rather faint, but the northern, for 60° or so, strikingly bright and well defined, though without any trace of prismatic colour. I could not distinguish that one edge was fainter than the other. The width exceeded little, if at all, double the diameter of the moon.

Asgarth, Purley, October 22nd, 1915. J. EDMUND CLARK.

REVIEWS.

Publications of the West Hendon House Observatory, Sunderland. No. IV., Meteorological Observations. By T. W. BACKHOUSE, F.R.A.S., F.R.Met.Soc. Sunderland, 1915. Size, 11½ × 9. Pp. 188 (44 plates).

MR. BACKHOUSE'S splendid series of observations of natural phenomena, extending back to 1857, find a fitting embodiment in these beautifully printed and lavishly illustrated memoirs. The observations although for the most part non-instrumental, nevertheless cover a wide range of meteorological phenomena. The most valuable portion of the work appears to us to be the very complete series of wind observations and the co-ordination of the wind and rainfall records. The monthly wind roses show that, as regards frequency, the westerly component preponderates in every month, though very slightly so in the early summer. The amount of rain recorded with each wind direction is set out in the same way, showing that an overwhelming proportion falls with winds blowing off the sea (N. to S.E.), especially in the winter. This is, of course, what one would expect to find at an east coast station, but the establishment of a numerical relationship is an advantage.

In the following table the rain which fell during calms and periods when no observations were available has been divided proportionately.

Average rainfall at Sunderland per 100 hours with each wind direction.

	N. in.	N.E. in.	E. in.	S.E. in.	S. in.	S.W. in.	W. in.	N.W. in.
January	·89	·64	·54	·48	·20	·15	·08	·30
February	·41	·35	·40	·59	·21	·11	·07	·22
March	·46	·40	·44	·46	·16	·11	·07	·27
April	·28	·26	·31	·31	·20	·14	·12	·26
May	·35	·26	·40	·29	·30	·19	·12	·34
June	·29	·31	·36	·30	·50	·14	·10	·37
July	·52	·57	·53	·37	·66	·27	·19	·42
August	·54	·53	·63	·46	·64	·31	·13	·50
September	·36	·54	·55	·36	·28	·24	·12	·40
October	1·14	·99	·74	·55	·26	·17	·11	·65
November	1·15	·68	·59	·76	·25	·15	·11	·54
December	1·06	1·01	·81	·85	·27	·14	·08	·55
Whole year	·51	·50	·51	·46	·28	·17	·10	·41

In discussing the long rainfall record at Sunderland, the author devotes an interesting section to a somewhat theoretical discussion of the relative value of the geometric mean and the arithmetical average for the purpose of expressing normal rainfall.* A preference for the geometric mean is based on the argument that the object of obtaining a rainfall normal is that of ascertaining what is the

* See *Q.J.R.Met.Soc.*, Vol. 17, p. 87.

most probable quantity, that is, presumably, the figure from which deviation will be of least average magnitude. Many meteorologists will dissent from this view, preferring to regard the normal as merely a convenient mode of expressing the total rainfall over a long series of years. Some point is lent to the objection since by the author's own showing in the case of daily rainfall the value which complies with his definition is 0. In the case of monthly rainfall also it is noteworthy that the geometric mean values for the twelve months add up to a total about 3 inches smaller than the geometric mean for the whole year. With yearly totals the geometric mean for 46 years at Sunderland differs from the arithmetical average only by a small fraction of an inch, or an amount smaller than the limit of observational error. These facts seem to show that the geometric mean cannot apply in the case of very widely varying quantities, and that, even if it can be shown to be theoretically more applicable when the variations are smaller, when this is the case it approximates so closely to the arithmetical average that the gain in accuracy is incommensurate with the greatly increased labour of computation.

Return as to Water Undertakings in England and Wales. Issued by the Local Government Board, London. 1915. Size, 13 × 8. Pp. xli. + 599. Price 5s. 1d.

This return is the first instalment of the detailed and comprehensive investigation of water supplies recommended by various Royal Commissions and Departmental Committees. It consists for the most part of a complete list of public and private water supply undertakings in England and Wales, giving particulars of the nature and sources of the supply, the population and area supplied, and other important details in each case. The return is an indispensable preliminary to the creation, strongly urged by the Commission of 1910, of a Central Administrative Authority for the control of water supplies, together with the formation of Rivers Boards charged with inquiry into the local conditions in each river-basin. The most interesting feature of the proposal from a meteorological point of view is the suggestion that the Water Authority should take cognizance of all questions "both atmospheric and geological," which affect water supplies. It is not stated by what machinery it is proposed to deal with such questions, though no doubt geological matters would come naturally within the scope of the Geological Survey Department of the Board of Education. The detailed study of the distribution of rainfall which forms one of the most important branches of water

engineering has never engaged the attention of any Government Department, and the British Rainfall Organization, founded in 1860, by the late Mr. G. J. Symons, and maintained by private enterprise ever since, has been invariably made use of when any question of water supply has arisen. It is perhaps hardly too much to claim that, had the Organization served no other purpose during its long career, its maintenance would have been amply justified by its public utility in this respect alone. An accurate knowledge of the average rainfall of any area from which water supplies are drawn, is, of course, vital, not only as a guarantee of the sufficiency of the supply itself, but also for the purpose of preventing the undue depletion of streams by overtaxing their resources, a very real danger if large works are designed without the help of sufficient data as to the amount of rain which may be expected. Under central control it may be assumed that every local authority would be put under an obligation to maintain rainfall records, so that a considerable strengthening of the existing network of rainfall stations would accrue, from which meteorology would gain largely, but it is worth while to point out that such a step would not of itself provide the data necessary for computing the average rainfall of water areas for very many years to come. Such average values can only be arrived at by comparison with the long records collected and preserved by the British Rainfall Organization, and can only be interpreted by the application of the knowledge of the laws governing rainfall distribution, which are gradually emerging from the study of these records.

METEOROLOGICAL NEWS AND NOTES.

Mr. R. M. Barrington, of Fassaroe, Bray, Co. Wicklow, one of the Trustees of the British Rainfall Organization, died suddenly on September 15th, to the great regret of all students of meteorology, and we hope to publish some account of Mr. Barrington's meteorological work in an early number.

Mr. F. Campbell Bayard and Commander W. F. Caborne, C.B., R.N.R., have resigned their positions as Secretaries of the Royal Meteorological Society, and, at the request of the Council, Mr. R. G. K. Lempfert has consented to act as Secretary until the annual meeting of the Society.

Mr. George O. Wiggin, for many years one of the two Subdirectors of the Argentine Meteorological Service, has been appointed Acting-director, Dr. Martin Gil having declined office after his nomination as Director.

RAINFALL TABLE FOR OCTOBER, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH.	
					Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·72	2·06
Tenterden	*Kent*	51 4	*0 41	190	3·48	1·74
Arundel (Patching)	*Sussex*	50 51	0 27	130	4·01	3·83
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	4·07	3·53
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·82	2·31
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	2·60	1·06
Shoeburyness	*Essex*	51 31	*0 48	13	2·31	2·07
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·72	1·11
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·84	...
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	4·84	3·91
Rousdon [Lyme Regis]	,,	50 41	3 0	516	3·81	7·24
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	3·21	3·88
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	3·77	3·13
Boston	*Lincolnshire*	52 58	0 1	11	2·75	1·48
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	2·77	1·08
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·81	1·91
Macclesfield	*Cheshire*	53 15	2 7	501	3·53	1·37
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	3·74	1·33
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	6·48	1·34
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	3·18	1·25
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	3·19	·99
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	3·20	1·33
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	12·71	3·26
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	4·87	4·70
Haverfordwest	*Pembroke*	51 48	4 58	90	5·51	4·92
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	5·38	2·71
Llandudno	*Carnarvon*	53 20	3 50	72	3·78	1·84
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·45	4·03
Marchmont House	*Berwick*	55 44	2 24	498	3·83	2·64
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	5·38	4·06
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·36	2·23
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	6·50	3·05
Mull (Quinish)	,,	56 34	6 13	35	5·87	2·38
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·81	2·65
Braemar	*Aberdeen*	57 0	3 24	1114	3·88	3·99
Aberdeen (Cranford)	,,	57 8	2 7	120	3·23	2·90
Gordon Castle	*Moray*	57 37	3 5	107	3·38	1·88
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	4·14	1·61
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	8·38	3·13
Dunrobin Castle	*Sutherland*	57 59	3 56	14	3·15	1·50
Wick	*Caithness*	58 26	3 6	77	3·14	1·08
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	5·59	5·25
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	4·00	7·15
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·48	3·26
Ennistymon House	*Clare*	52 57	9 18	37	4·40	4·45
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·75	5·81
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·53	3·93
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·88	...
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·19	3·57
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	5·27	5·34
Cong (The Glebe)	,,	53 33	9 16	112	4·60	5.06
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	4·21	3·90
Seaforde	*Down*	54 19	5 50	180	3·65	4·52
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·60	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·76	3·07

RAINFALL TABLE FOR OCTOBER, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875–1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875–1909. in.	STATION.
— ·66	76	·99	31	12	20·64	24·23	+3·59	117	25·11	Camden Square
—1·74	50	·49	31	17	21·80	24·29	+2·49	111	27·64	Tenterden
— ·18	96	·84	31	10	24·03	30·60	+6·57	127	30·48	Patching
— ·54	87	1·01	31	15	25·25	31·18	+5·93	124	31·87	Cadland
— ·51	82	·83	31	11	20·27	22·89	+2·62	113	24·58	Oxford
—1·54	41	·38	27	10	20·85	18·26	—2·59	88	25·20	Swanspool
— ·24	90	·72	19	20	15·48	18·34	+2·86	118	19·28	Shoeburyness
—1·61	41	·34	27	11	20·86	18·86	—2·00	90	25·40	Westley
...	...	..	...	...	19·17	...	...	...	23·73	Geldeston
— ·93	81	·76	23	18	29·74	33·36	+3·62	112	38·27	Polapit Tamar
+3·43	190	2·22	23	18	26·35	28·98	+2·63	110	33·54	Rousdon
+ ·67	121	1·18	23	14	24·33	25·82	+1·49	106	29·81	Stroud
— ·64	83	·99	23	12	26·48	30·02	+3·54	113	32·41	Wolstaston
—1·27	54	·56	27	14	19·42	19·16	— ·26	99	23·35	Boston
—1·69	39	·49	27	14	20·31	18·20	—2·11	90	24·46	Hodsock Priory
— ·90	68	·62	27	12	22·06	24·10	+2·04	109	26·65	Mickleover
—2·16	39	·47	27	10	28·38	27·29	—1·09	96	34·73	Macclesfield
—2·41	36	·43	23	13	26·44	23·47	—2·97	89	32·70	Southport
—5·14	21	·70	27	12	48·62	39·09	—9·53	80	61·49	Arncliffe
—1·93	39	·43	27	6	22·26	21·40	— ·86	96	26·87	Ribston Hall
—2·20	31	·30	27	14	21·76	20·34	—1·42	93	26·42	Hull
—1·87	42	·20	19	17	22·85	18·12	—4·73	79	27·94	Newcastle
—9·45	26	1·00	25	8	100·75	76·50	—24·25	76	129·48	Seathwaite
— ·17	97	·75	23	24	33·50	28·89	—4·61	86	42·28	Cardiff
— ·59	89	1·03	27	17	36·47	36·30	— ·17	100	46·81	Haverfordwest
—2·67	50	·71	23	17	36·30	33·12	—3·18	91	45·46	Gogerddan
—1·94	49	·47	24	14	24·33	24·11	— ·22	99	30·36	Llandudno
— ·42	91	1·61	23	13	34·28	34·02	— ·26	99	43·47	Cargen
—1·19	69	·53	27	14	27·72	24·16	—3·56	87	33·76	Marchmont
—1·32	75	1·44	24	17	39·05	35·74	—3·31	92	49·77	Girvan
—1·13	66	·83	23	11	28·39	22·28	—6·11	78	35·97	Glasgow
—3·45	47	·65	11	14	52·71	46·81	—5·90	89	68·67	Inveraray
—3·49	41	·56	28	16	43·74	34·35	—9·39	79	56·57	Quinish
— ·16	94	·84	28	19	23·35	22·30	—1·05	96	28·64	Dundee
+ ·11	103	1·44	28	16	28·04	32·07	+4·03	114	34·93	Braemar
— ·33	90	·90	28	19	26·01	26·42	+ ·41	102	32·73	Aberdeen
—1·50	56	·55	28	19	24·77	28·21	+3·44	114	30·34	Gordon Castle
—2·53	39	·59	11	13	34·40	25·60	—8·80	74	44·53	Fort Augustus
—5·25	37	·78	11	11	65·17	55·98	—9·19	86	83·93	Bendamph
—1·65	48	·28	17	10	25·56	23·15	—2·41	91	31·90	Dunrobin Castle
—2·06	34	...	.	...	23·82	18·09	—5·73	76	29·88	Wick
— ·34	94	·88	7, 20	23	42·35	39·09	—3·26	92	54·81	Killarney
+3·15	179	2·35	7	16	31·45	31·65	+ ·20	101	39·57	Waterford
— ·22	94	·90	27	18	31·21	30·54	— ·67	98	39·43	Castle Lough
+ ·05	101	·97	27	20	36·87	36·32	— ·55	99	46·52	Ennistymon
+2·06	55	1·40	7	18	28·16	28·23	+ ·07	100	34·99	Courtown Ho.
+ ·40	111	·95	7	17	29·23	28·16	—1·07	96	35·92	Abbey Leix
..	...	...	...	...	22·77	...	...	...	27·68	Dublin
+ ·38	112	1·15	1	11	29·38	33·20	+3·82	113	36·15	Mullingar
+ ·07	101	·99	27	20	41·01	39·96	—1·05	97	52·87	Enniscoe
+ ·46	110	1·00	7	16	38·48	37·37	—1·11	97	48·90	Cong
— ·31	93	1·00	7	17	34·35	35·41	+1·06	103	42·71	Markree
+ ·87	124	·72	24	16	31·28	29·95	—1·33	96	38·91	Seaforde
...	...	...	...	...	29·92	...	...	...	37·56	Dundarave
— ·69	82	·82	19	18	31·81	30·47	—1·34	96	39·38	Omagh

SUPPLEMENTARY RAINFALL, OCTOBER, 1915.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	2·75	XI.	Lligwy	2·69
,,	Ramsgate	2·56	,,	Douglas	5·50
,,	Hailsham	4·05	XII.	Stoneykirk, Ardwell House...	4·77
,,	Totland Bay, Aston House...	3·85	,,	Carsphairn Shiel	6·01
,,	Stockbridge, Ashley..	3·83	,,	Beattock, Kinnelhead	3·14
,,	Grayshott	4·56	,,	Langholm, Drove Road	2·18
III.	Harrow Weald, Hill House...	2·22	XIII.	Meggat Water, Cramilt Lodge	2·64
,,	Caversham, Rectory Road ...	2·99	,,	North Berwick Reservoir... ..	2·05
,,	Pitsford, Sedgebrook...	1·77	,,	Edinburgh, Royal Observaty.	2·00
,,	Woburn, Milton Bryant	1·70	XIV.	Maybole, Knockd. n Farm ...	1·75
,,	Chatteris, The Priory	1·46	XV.	Ballachulish House	3·33
IV.	Elsenham, Gaunts End	1·43	,,	Campbeltown, Witchburn ..	4·56
,,	Colchester, Hill Ho., Lexden	1·42	,,	Holy Loch, Ardnadam	4·50
,,	Ipswich, Rookwood, Copdock	1·38	,,	Islay, Eallabus	3·21
,,	Blakeney	1·91	,,	Tiree, Cornaigmore	2·96
,,	Swaffham	1·29	XVI.	Dollar Academy	2·20
V.	Bishops Cannings	4·19	,,	Balquhidder, Stronvar	..
,,	Wimborne, St. John's Hill ...	6·53	,,	Glenlyon, Meggernie Castle..	4·65
,,	Ashburton, Druid House.. ..	7·34	,,	Blair Atholl	3·86
,,	Cullompton	4·77	,,	Coupar Angus	4·29
,,	Lynmouth, Rock House	3·91	,,	Montrose, Sunnyside Asylum.	3·13
,,	Okehampton, Oaklands.. ...	4·04	XVII.	Alford, Lynturk Manse	6·17
,,	Hartland Abbey	3·85	,,	Fyvie Castle	5·02
,,	Probus, Lamellyn	4·91	,,	Keith Station ..	3·73
,,	North Cadbury Rectory.	5·26	XVIII.	Rothiemurchus	·86
VI.	Clifton, Pembroke Road	4·75	,,	Loch Quoich, Loan	5·05
,,	Ross, The Graig	4·62	,,	Drumnadrochit ..	1·84
,,	Shifnal, Hatton Grange.	2·09	,,	Skye, Dunvegan	3·52
,,	Droitwich	3·72	,,	Lochmaddy, Bayhead	2·74
,,	Blockley, Upton Wold	3·18	,,	Glencarron Lodge	2·19
VII.	Market Overton	1·06	XIX.	Inversbin ..	1·48
,,	Market Rasen	1·13	,,	Melvich	2·06
,,	Bawtry, Hesley Hall	·96	,,	Loch Stack, Achfary	1·07
,,	Derby, Midland Railway	1·59	XX.	Dunmanway, The Rectory ..	7·90
,,	Buxton	2·35	,,	Glanmire, Lota Lodge	6·60?
VIII.	Nantwich, Dorfold Hall	1·73	,,	Mitchelstown Castle	5·50
,,	Chatburn, Middlewood	1·86	,,	Darrynane Abbey	9·76
,,	Lancaster, Strathspey	1·09	,,	Clonmel, Bruce Villa	4·10
IX.	Langsett Moor, Up. Midhope	1·93	,,	Newmarket-on-Fergus, Fenloe	3·29
,,	Scarborough, Scalby	1·69	XXI.	Laragh, Glendalough	6·88
,,	Ingleby Greenhow	1·70	,,	Ballycumber, Moorock Lodge	3·29
,,	Mickleton	·60	,,	Balbriggan, Ardgillan	4·57
X.	Bellingham, High Green Manor	3·97	XXII.	Ballynahinch Castle	8·22
,,	Ilderton, Lilburn Cottage ...	1·91	,,	Woodlawn	3·97
,,	Keswick, The Bank	·89	,,	Westport, St. Helens	4·09
XI.	Llanfrechfa Grange	4·71	,,	Dugort, Slievemore Hotel ...	8·46
,,	Treherbert, Tyn-y-waun	6·30	,,	Mohill Rectory	3·70
,,	Carmarthen, The Friary	3·11	XXIII.	Enniskillen, Portora	2·38
,,	Fishguard, Goodwick Station.	3·61	,,	Dartrey [Cootehill]	2·60
,,	Crickhowell, Tal-y-maes	6·00	,,	Warrenpoint, Manor House ..	5·33
,,	New Radnor, Ednol	4·20	,,	Banbridge, Milltown	2·94
,,	Birmingham WW., Tyrmynydd	3·47	,,	Belfast, Cave Hill Road	3·36
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	3·25
,,	Llangynhafal, Plâs Draw	2·64	,,	Londonderry, Creggan Res...	1·93
,,	Dolgelly, Bryntirion	2·45	,,	Dunfanaghy, Horn Head ...	2·85
,,	Bettws-y-Coed, Tyn-y-bryn...	2·20	,,	Killybegs	5·21

THAMES VALLEY RAINFALL —— OCTOBER, 1915.

Symons's Meteorological Magazine.

Watershed of River Thames above Teddington, and River Lea above Feildes Weir

Rainfall Stations reporting

Isohyetals

THE WEATHER OF OCTOBER.

THE mean temperature of October was slightly more than a degree above the average in the north of Scotland, the east of England and in Ireland, but in the Channel Islands the mean was a degree under the average. In the central parts of Great Britain nearly average conditions obtained, there being thus, over the whole country, a remarkably even temperature. Sunshine was everywhere in defect, the greatest deficiency, amounting to about an hour and a half a day, being noted in the Midlands. In the east of Scotland, the N.W. of England and the south of Ireland the deficiency was less marked.

During the first six days fine cold weather provailed generally, except on the 4th and 5th, when heavy showers fell on the coast of Kent. Frost was common and on the early morning of the 5th and 6th the shade thermometer fell to 28° at Kilmarnock, and at Newton Rigg, and to 22° at West Linton, the lowest readings of the grass thermometer being 19° at Gordon Castle and West Linton. On the 7th the advance of a depression from the west caused strong southerly winds, accompanied by heavy rain on the Devon-Cornwall Peninsula and in Ireland. On the 7th as much as 3·05 in. of rain fell at Foffany Reservoir, Co. Down, and 2·75 in. at Glendalough, Co. Wicklow (in twelve hours). On the 8th the depression filled up an anti-cyclone centred over Scandinavia dominating conditions in the British Isles, until about the 12th, when the temperature in most districts rose above 60°, reaching 68° at Geldeston, Margate and London. As far north as Gordon Castle a maximum of 65° was noted on the 13th. Cool weather prevailed at Scilly about this time, the maximum being only 61°. From the 13th to the 22nd the weather was very variable, although dry. There was a good deal of cloud with relatively high minimum temperatures and at times much mist and fog. Temperature was above the normal, touching 64° at Killarney and 65° at Waterford on the 17th. A brilliant aurora was observered at some Irish and Scottish stations on the 14th. Heavy rain fell at a number of stations on the 23rd, when a cyclonic disturbance lay over Ireland. The falls reported exceeded two inches at many stations. An easterly gale blew in the Channel on the 24th, and on the 25th at various exposed parts of our southern coasts. Very heavy rains were experienced in Ireland on the 27th and in the north-east of Scotland on the 28th. On the former date as much as 3·55 in. fell at Foffany Reservoir, Co. Down, and on the 28th the following heavy falls were noted in Aberdeenshire, viz., 3·41 in. at Crathes; 2·55 in. at Fyvie Castle; 2·12 in. ar Lynturk Manse; and 1·93 in. at Balmoral. At Crathes 5·14 in. fell in 42 hours. Mr. Smith, of Crathes, reports that the River Dee was in high flood, but not so high by several feet as it was in May, 1913.

Less than half the average rainfall for the month fell over the west and north-west of Scotland, and over the northern half of England and Wales. Nearly the whole of Great Britain had a rainfall under the average. An area in which the average was exceeded occurred in Aberdeenshire, and there was another area of excess in Wessex. The greater part of Ireland was wet, except in northern inland districts. In the Thames Valley less than two inches fell in the north-east and in part of the upper Thames, and the range shown in the accompanying map exceeds six inches, the fall being less than one inch in the north-east and as much as seven inches in the south-west. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was as follows: England and Wales, 63; Scotland, 60; Ireland, 112; British Isles, 73.

The following amounts of sunshine were reported: Camden Square, 48 hours; Totland Bay, 93 hours; Copdock, 83 hours; Sidmouth, 78 hours; Weymouth, 81 hours; Felsted, 79 hours; Southport, 72 hours; Hull, 39 hours; Haverfordwest, 98 hours; Paisley, 53 hours; Loch Stack, 120 hours; Perth, 76 hours. In London (Camden Square), the mean temperature was 49°·8, or 0°·3 below the average. Duration of rain, 54·5 hours. Evaporation, ·56 in.

Climatological Table for the British Empire, May, 1915.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
								0-100			inches		
London, Camden Square	82°0	26	36°3	15	67°4	45°5	45°6	72	126°8	31°8	3·72	8	4·6
Malta	76·6	19	54·6	1	70·5	61·3	...	90	136·0	...	·04	1	1·5
Lagos	90·0	*20	72·0	§4	88·0	75·6	74·5	75	161·0	69·0	11·52	18	6·3
Cape Town	86·9	15	37·8	26	68·9	51·9	50·6	72	...	...	1·94	10	4·6
Natal, Durban ...	...	...	...	...	...	...	...	..	...	...	...	...	...
Johannesburg	70·2	1	31·2	15	62·8	44·5	43·5	78	...	29·9	1·36	5	3·4
Mauritius	84·6	6	55·5	18	79·5	67·7	65·5	77	...	47·6	3·33	17	5·6
Bloemfontein	75·4	2	30·7	9	66·3	38·6	37·8	67	..	...	·90	5	2·8
Calcutta...	103·1	18	72·9	6	94·4	79·6	77·6	77	...	69·2	5·65	8	5·0
Bombay...	94·2	26	79·4	1	92·0	82·4	77·2	73	136·0	66·7	·36	4	3·9
Madras	107·3	†12	77·4	5	101·8	82·6	74·3	65	158·4	76·1	·36	2	2·9
Colombo, Ceylon ...	91·2	7	73·7	26	89·0	79·3	76·6	79	160·3	71·2	11·00	18	7·8
Hongkong	87·7	22	64·7	14	79·9	72·0	70·3	84	...	...	12·76	22	8·3
Sydney	72·0	2, 9	44·0	25	64·2	51·8	48·5	71	119·4	31·8	4·84	9	4·0
Melbourne	76·0	1	35·8	12	60·3	46·7	44·4	70	119·2	28·3	3·97	18	6·2
Adelaide	80·0	1	41·8	4	64·1	49·5	47·6	70	130·4	28·4	2·90	13	6·0
Perth	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie	81·8	1	40·4	15	67·5	49·9	46·8	63	140·2	35·0	3·12	10	4·7
Hobart, Tasmania ..	70·0	2	37·0	10	57·2	44·8	41·0	66	113·0	29·8	2·35	20	7·0
Wellington	65·4	3	35·2	25	59·1	46·5	45·7	78	120·6	25·0	1·12	11	6·6
Auckland	65·0	‡10	40·0	15	61·1	51·1	50·5	82	123·0	37·0	3·79	22	5·6
Jamaica, Kingston ..	91·0	7	67·9	1	87·6	73·5	72·8	76	...	...	3·08	5	...
Grenada	89·0	3	72·0	6	86·0	75·3	...	77	135·0	...	3·75	16	5·0
Toronto	74·4	12	32·9	10	61·7	42·6	40·4	68	128·8	29·0	1·60	11	4·4
Fredericton	75·0	7	0·0	21	59·6	38·5	41·0	73	...	...	5·23	14	6·4
St. John, N.B. ...	69·3	23	31·5	27	53·8	39·7	42·0	68	...	...	4·73	13	6·4
Alberta, Edmonton ...	80·0	9	27·2	7	65·0	41·7	...	62	136·8	20·0	2·21	13	6·3
Victoria, B.C.	72·4	4	42·0	1	60·4	47·5	47·0	78	139·8	36·6	1·26	13	6·5

* 21. † 20, 21, 23. ‡ 20. § 19, 28, 29.

Johannesburg—Bright sunshine 272·8 hours.

Mauritius—Mean temp. 0°·5, dew point 1·0, and R ·06 in. above averages. Mean hourly velocity of wind ·17 mile per hour above average.

COLOMBO, CEYLON—Mean temp. 84°·2 or 1°·3 above, dew point 0°·7 above, and R ·11 in. below, averages. TS on 7 days.

HONGKONG—Mean temp. 75°·5, mean hourly velocity of wind 11·8 miles. Bright sunshine 103·7 hours.

Sydney—Mean temp. 0°·6 below average.

Melbourne—Mean temp. 0°·5 below, and R 1·80 in. above, averages.

Adelaide—Mean temp. 0°·9 below, and R ·20 in. above, averages.

Coolgardie—Temp. 1°·1 above, and R 1·75 in. above, averages.

Hobart—Mean temp. 0°·6 above, and R ·48 in. above, averages.

Wellington—Mean temp 0°·8 above, and R 3·68 in. below, averages. Bright sunshine 143·5 hours.

Auckland—Showery R ·71 in. below, and mean temp. slightly below, averages.

ALBERTA, EDMONTON—Cloudy, damp and warm. TSS on four days. Slight S on 6th. Aurora on 11th and 12th.

Symons's
Meteorological Magazine.

No. 599. DECEMBER, 1915. Vol. L.

Richard Manliffe Barrington.

1849—1915.

Mr. R. M. Barrington, of Fassaroe, Bray, Co. Wicklow, inherited from his father, Mr. E. Barrington, a love of nature and of observation which made him, for many years, the leading Irish naturalist, using the word with all the breadth and fulness that it carried in the days of White of Selborne. While devoted to Botany and Meteorology, it was Ornithology which absorbed most of the time and enthusiasm which Mr. Barrington lavished on the study of nature in Ireland. He had published his first paper on a point in bird life before he entered Trinity College, Dublin, in 1865, and his labours in this direction culminated in his great volume on the Migration of Birds, as observed at the Irish Lighthouses. By profession a barrister, Mr. Barrington found more congenial occupation under the Irish Land Commission and in the management of his own picturesquely situated estate. As a young man he was an ardent mountain climber and his exploits in the Alps are still remembered for the large number of difficult peaks which he ascended in rapid succession within a few days. A rainfall record had been established at Fassaroe the year before Mr. Barrington was born, and it appeared in *British Rainfall* from 1860 to 1875, under the name of his father; from that time the familiar name of R. M. Barrington has never been absent from the annual volumes. The records before 1853 have, unfortunately, been lost, but in 1905, Mr. Barrington, with the help of Mr. A. Hampton Brown, now assistant secretary of the Royal Meteorological Society, made a complete discussion of the Fassaroe rainfall for 50 years. This valuable contribution to Irish climatology remains unpublished. Mr. Barrington frequently attended the meetings of the British Association, and we retain the happiest recollection of his hospitality when the Association met in Dublin in 1908. It was natural that when Trustees were appointed for the British Rainfall Organization in 1910, the name of Mr. Barrington should be proposed as representing Ireland, and we have to acknowledge gratefully the continuous interest which he showed in the success of the rainfall work and his unvarying kindness on all occasions.

Mr. Barrington's genial helpfulness to the younger students of Natural History in Ireland did much to encourage the systematic study of several branches of science and the application of scientific observation to agriculture and the welfare of the community. Mr. Barrington died very suddenly from a heart attack, on the 15th of September, while driving his motor car home from Dublin. The rainfall observations at Fassaroe have not been interrupted, but are being carried on by Mrs. Barrington and her family, who have always been in the fullest sympathy with Mr. Barrington's scientific pursuits.

AN APPRECIATION

By Sir John Moore, M.D., D.Sc.

Through very many years it was my privilege to enjoy the close personal friendship of Richard Manliffe Barrington, or "Dick Barrington," as his many intimate friends, including myself, were wont to call him.

It was in relation to weather and climatology that he and I were brought into closest contact, and whenever anything out of the common occurred in connection with the weather, a written, or in later years a telephonic, message would be sure to reach me from Fassaroe, Barrington's charming residence between Bray and Enniskerry, in the Co. Wicklow. The Fassaroe meteorological observations extend back, so far as rainfall is concerned, to the year 1853, and from 1864 to the present date full temperature records have been kept in addition. From 1837 to 1863 the date on which harvest began at Fassaroe each year was carefully noted by Barrington's grandfather and father, so that his bent towards weather observation was hereditary. The Fassaroe records must be amongst the oldest extant in Ireland, and I am glad that they are being continued by Mrs. Barrington.

But my friend did not confine his scientific pursuits to weather-lore and climatology. He was a naturalist of the first rank, and justice has been done elsewhere to his far-reaching knowledge of plants and birds. It was my good fortune in August, 1909, to travel across the Atlantic with him in the Canadian Pacific Railway Company's splendid steamer, the *Empress of Ireland*, which, years afterwards, met such an untoward fate in the St. Lawrence, off Rimouski. We were bound for the meeting of the British Association at Winnipeg. On that memorable voyage nothing escaped Barrington's keen observation. Every sea bird was observed, recognized, and named. I shall never forget his informal discourses on the habits of the shearwater and the other winged inhabitants of the air above the ocean. In Barrington's death, Ireland has lost a true and worthy son, and Irish science one of its most cultured exponents.

PROFESSOR PETTERSSON ON LUNAR PERIODS IN SOLAR AND TERRESTRIAL CLIMATE.

By L. C. W. BONACINA.

THE well-known Swedish oceanographer, Professor Otto Pettersson, has published in English the results of certain laborious and abstruse investigations which he and collaborators have conducted in the sphere of cosmical physics.* In the present notice I venture to express no opinion upon the intrinsic value of these researches, except to say that the evidence for the theory upheld does not seem conclusive, and that the "resonance" explanation of sunspots requires much more substantial justification, but merely offer a condensed statement of some of the more interesting and anomalous results together with a short discussion of a few of the questions raised. The subject, as suggested by the title, discusses an apparently remarkable commensuration of the moon's periods with sunspot periods on the one hand, and terrestrial climatic periods on the other, and so may be treated from both a geographical and astronomical standpoint. A preliminary statement may be thus given :—there are periodic changes of longer and shorter duration in the position of the moon's orbit, and these periods underlie variations of well known phenomena in the hydrosphere and atmosphere of the earth, and in the photosphere of the sun. It is shown that once in about eighteen centuries the line of the moon's apsides at the time of peri-helion (about winter solstice) falls in the ecliptic, and the apogee apex is directed towards the sun, a configuration, it is held, which raises the tide-generating force to a maximum—of the sun and moon upon the earth at the time of full moon, and of the earth and moon upon the sun at new moon. There are minor periods of 90, 18, 9, $4\frac{1}{2}$, etc., years, dependent on other configurations, giving rise to secondary, tertiary, and weaker maxima of the tidal force, but these need not be specifically detailed here. The last absolute maximum of the tide-producing force occurred about the end of the Middle Ages, and the one before that in the 3rd or 4th century B.C., the intervening minimum falling at the beginning of the Viking Age. There is evidence that at both maximum epochs violent storm floods and catastrophic inundations used to occur on the Atlantic coasts in conformity with the more powerful tides which were then raised, and that there were climatic alterations in different parts of the world connected with the increased tidal energy of the oceans. But it is not only in the surface phenomena of bigger flood waves

* On the occurrence of lunar periods in solar activity and the climate of the Earth : a study in geophysics and cosmic physics.

On climatic variations in historic and prehistoric time. (Ur Svenska Hydrografisk-Biologiska Kommissionens Skrifter, Häft V). Quarto. Maps, illustrations and curves.

and greater difference between spring and neap tides that the effects are apparent, inasmuch as an important part is alleged to be played by the locally generated submarine tidal waves, which according to their intensity are shown to give rise indirectly to marked changes in the superincumbent air as will now be explained. The submarine waves whose tidal nature has been demonstrated by Professor Pettersson and his collaborators, are engendered when the oceanic tidal wave impinges on submarine ridges such as occur in the North Atlantic, and, travelling on, persist in the boundary layer, where lighter surface water overlies salt deep-water—a stratification common in the Arctic seas and in the Baltic, Skagerak and Cattegat. It is pointed out that in the 13th, 14th and 15th centuries the Baltic in certain winters was completely frozen over, and that the *prima causa* of this was oceanographic and not meteorological—lying in the stronger influx of Atlantic water through the Belts and Sound which caused the light surface water down to the boundary layer in the Baltic to flow out and grow thinner, and so freeze more readily than in times of weaker tidal influx like the present. But the frozen sea surface would react upon the climate increasing both the cold and the atmospheric pressure, whilst in summer the same shallowness of the Baltic surface layer resulting from the swelling up of the under layer would lead to its more rapid heating, and thus tend to bring about greater warmth in the Scandinavian countries, such a conjecture as to a more continental climate being actually borne out by observations of Tycho Brahe. To the more intense tidal circulation must likewise be attributed the great Hanseatic herring fisheries of the Middle Ages, the present day migrations of these fish not extending nearly so far into the Baltic. Concerning probable climatic variations in other regions, Prof. Pettersson discusses the case of Iceland and Greenland at special length, since his views are at variance with those of Dr. Nansen on this subject, as are they also in relation to the "Wineland" controversy. Multifarious historical evidence is adduced by Pettersson testifying to the prevalence in the Viking Age of such mild conditions in Greenland that the eastern coast was quite accessible to the Norse colonists, and that the coast of Iceland was not subject to its present-day bombardments by polar ice. The comparative mildness and fertility of Greenland at that epoch is attributed to a greater intensity of the Irminger branch of the Gulf Stream, the effect of which was to cause the Arctic ice to melt in higher latitudes. But at a later period towards the end of the Middle Ages, when the tide-generating force waxed to a maximum, the circulation of the Atlantic became altered, and great submarine waves entered the Polar basin, resulting in the breaking up of large quantities of ice to be carried southward by the current which chills the coast of Greenland. It is maintained

on grounds which Nansen is stated to reject on account of the gentle disposition of the present-day Eskimo, that the deterioration of the climate of Greenland to something like modern conditions necessitated a southward migration from far northern regions of the aboriginal race to the extermination of the European colonists.

The solar aspect of the lunar influences under review is studied in relation to the phenomena of sunspots, as intimated above; but while the discovered relationship between the moon periods and the sunspot periods seems difficult to ignore, still more to deny, the explanation is very recondite, and, as attempted by Pettersson, it is couched in a form which is not easy to follow. The only planetary influence which appears to be connected with the sunspot periods is that due to the earth-moon system, and the outstanding anomaly which should engage the attention of cosmical physicists is this: that while the position of the moon's orbit relative to that of the earth is shown to undergo changes of the same periodicity as the sunspots, the latter are not, essentially at least, gravitational phenomena. Pettersson has constructed by harmonic analysis, using various lunar periods for basis, the frequency of sunspots as expressed in the tables of Wolf, revised in 1902 by Wölfer, with the apparently fortunate result that the resemblance between the original curve and the reconstruction according to moon periods is very close. There are many long and short periods contained in the sunspot curve for the last couple of centuries, including the well-known one of 11 years, itself composed of the 9 and 13-year periods, and these can be detected in the variations of rainfall, temperature, and other meteorological elements in different parts of the world. An important feature of these sunspot periods is the fact first discovered by Schuster, that no single period dominates the sunspot frequency permanently, one period prevailing for a time and being supplanted by another, becoming for the time being latent. In this connection Pettersson points out that the periodicity of many meteorological and oceanographic phenomena remains unrecognized on account of the error of assuming that such periodicity must necessarily be permanent through the ages and discoverable by harmonic analysis. But what is of paramount interest in the relationship between the moon periods and the sunspot periods is the above-mentioned anomaly that the spots, intimately related though they be to the position of the moon, do not *per se* appear to be direct gravitational phenomena, but to represent a condition of the sun with respect to a certain intensity or distribution of gravitational (or other) impulses; for not only is the tide-producing power of the earth and moon upon the sun's surface of a small order of magnitude as expressed in the ordinary units, but there is the remarkable circumstance that the configuration of the earth, moon and sun known as peri-

helion-node-apside, which occasions the maximum tidal energy on both the earth and the sun, is marked by comparative rest in the sun's activity as denoted by the frequency of spots. The absolute maximum of spots is found to precede " perihelion-node-apside " by a considerable interval, and to occur when the orbits of the earth and moon take up an oblique (asymmetric) position to one another, and in the same way the lesser maxima of spots precede corresponding maxima of the tidal force on the sun. Professor Pettersson, who does not venture to speculate upon the *nature* of the force in action, further considers the sunspots to be the effects of resonance set up by the regularly repeated changes in the positions of the earth and moon, or to quote his own words, " The sunspots are effects of resonance of the rhythmically repeated symmetric and asymmetric constellations of the earth and moon . . ." In plainer language what would appear to happen is this : the sun (in relation to the spots) lies in a certain field of effective force, due to the earth and moon, the nature of which is possibly gravitational (or probably magnetic) and the intensity of which varies regularly with the relative positions of those bodies, but is never in itself great ; when, however, its small initial impulses are constantly repeated, it develops the full resonance effect of sunspots. There is, of course, the apparently opposing view among some astronomers that the spots are manifestations of volcanic energy and have an internal origin ; but as is generally the case in matters of well-grounded controversy, it will probably be found that both the external and internal theories are true, or partially so. For, whereas, on the one hand, the occurrence of lunar periods in the sunspot variations is a fact whose import cannot be ignored, on the other hand, having regard to a body of such consistency as the sun, it is only reasonable to assume that the spots are merely an index of more widespread, deep-seated changes in the sun due to the same external impulses which should thus be considered the prior cause.

To the thoughtful student of these researches of which we have here given a necessarily brief and inadequate exposition, a number of important questions will at once arise. Apart from their possibilities in long-period weather forecasting, of which Professor Pettersson and his coadjutors are fully cognizant, they bring up in a new light the old unscientific belief in the influence of the moon on weather, and profoundly affect also the conceptions of the climatologist. Now what, henceforth, is to be the answer of the meteorologist when confronted with the question, Has the moon any influence on the weather ? It is the man of science who alone knows the impossibility of giving simple answers to many scientific questions. In the present case it is clear that the nature of his answer should be guided by the character of the inquirer. The crude notions of those who believe, for instance, that the monthly phases of the

moon so govern the atmosphere that every new moon is a potential cause of a radical alteration in the state of the weather, any chance coincidence being at once attributed to cause and effect—*post hoc propter hoc*—will, of course, be refuted by the meteorologist as vigorously as heretofore. But he will be able to judge by the status of the enquirer when he might usefully explain that the varying position of the moon does appear to impose a certain modification, entirely subordinate to the major effects of solar heat, upon the intensity of the different weather elements. It may be noted, further, that while such lunar influence on the atmosphere as has been here discussed seems to act mainly through the medium of the oceanic tides, it cannot be definitely asserted that direct tidal effects in the atmosphere liable to affect the weather, do not also occur. Professor Strömberg has, indeed, launched the theory that tidal movements somewhat analagous to the "boundary waves" of the ocean, do occur in the different strata of the atmosphere; but it is well known that our barometers at the bottom of the sensibly uniformly deep compressible ocean of air fail to reveal those dominating gravitational impulses which are so conspicuous in the sea, and such tidal action as may occur in the atmosphere—whatever effect on the weather it may have—can only be brought to light through refined methods of mathematical analysis, adequate to extricate it from other over-riding factors.

Finally, it is evident that climatological conceptions will to a certain extent require re-adjustment in the light of these results—should they be corroborated. Although the subject of meteorological periodicities has often been investigated, it cannot be said that the result for the short time which has elapsed since the growth of instrumental observation has had far reaching consequences, and hitherto climatologists have for the most part neglected to consider their import, on the assumption that a series of, say, fifty years is long enough to include practically all the seemingly fortuitous variations and abnormalities of weather liable to occur in a given locality, and that such a run of years would furnish a set of mean values of pressure, temperature, rainfall, etc., substantially the same as that of any other period of fifty years in the same or another century.

But it has been shown above that it possibly requires a period of some eighteen centuries to furnish anything like a full climatic picture of the earth during the present geological epoch, with the result that the signification of a fifty years' average may be very much less than has been supposed. The climatologist, in other words, finds himself shipwrecked, and he must, in future, endeavour to navigate the waves of time with a knowledge that will enable him to recognize when he is sailing, say, on the crest of a tertiary maximum in the intensity of rainfall, or plunged into the trough of the corresponding minimum. I have elsewhere defined

"climate" as an expression denoting the frequency with which different states of weather, both common and rare, occur over a given area in the course of a considerable series of years. This definition must remain rigorously true when extended to embrace centuries, but its practical value in the course of a generation or the life of an individual is obviously not enhanced when examined in the light of such researches as Pettersson's.

In conclusion it should be noted that these alleged climatic changes of historic time are not to be confused with the far greater changes of geological time arising from quite other causes. The geological-time changes may themselves be to a certain extent of a periodic nature, forming a gigantic series of waves on which the historic periods are superimposed as mere ripples, but so slow is their course that the effect even after the lapse of centuries must be absolutely negligible.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

APPEAL FOR RECORDS, THUNDERSTORM OF JUNE 14th, 1914.

I AM continuing investigations as to the Meteorological conditions accompanying the Thunderstorms of June 14th, 1914 (see *British Rainfall*, 1914, pp. 48-56). I should be very grateful if anyone who has any records of any kind as to the weather on that day in any part of England, especially the south, would let me have them if they have not already done so. Autographic records would be carefully treated and returned. I have already had the records available at the Meteorological Office, but *any* other observations would be most welcome, cloud, sunshine, temperature, pressure, anything. Timed observations are obviously most useful.

J. FAIRGRIEVE.

Frocester, Friern Lane, New Southgate, N.

A REMARKABLE PERIOD OF LITTLE RAIN.

DURING the three months ending November 30th, my total rainfall has been only 3·83 in., and the number of rain days only 25. At any time of the year so low a record for three months would be remarkable, but it is still more so when it includes months with the high averages of October and November. Though no absolute

drought occurred, September had a period of 12 days, and November one of 13 days, without measurable rain.

	Rain days.	Rainfall.	Average of 15 years.
September	6	·70	2·65
October	12	1·14	4·45
November	7	1·99	3·98
TOTAL ...	25	3·83	11·08

W. G. WELCH.

Hampson-in-Ellel, Lancaster, December 1st, 1915.

NOVEMBER FROSTS, 1915, AND OTHERS.

THE invigorating period of frost—of the true solstitial or winter stamp—which immediately followed the violent gale of November 12th, 1915, and lasted without a real break in the cold type till the 29th, though, perhaps, of unusually long duration for so early a period in the winter, ought not to be overrated, in view of the fact that there have been many rigorous periods, both general and local, in the Novembers since the opening of the present century, to go no farther back. Whilst the thermometric intensity of the late frost will in due course, no doubt, be compared with that of previous frosts, I venture to assert that, having regard to the general character of the cold weather experienced, the frost which prevailed during the last ten days of November, 1904, was more severe over the kingdom generally. Minima below 20° were, I think, more general in 1904 than in 1915, whilst so far as London is concerned, the snowfall of 22nd November, 1904, was much heavier than that of the 17th, 1915. Then we must not overlook the intense skating week all over Scotland of mid-November, 1909; nor the Arctic temperatures and deep snows with which November, 1912, closed in the north, when *maxima* below 20° were recorded in Ayrshire and other Scottish districts. Moreover, November, 1910, was cold and snowy very generally; and several other Novembers brought sharp, if short, touches of cold, notably 1901, 1902, 1905, and 1914. Most people have piteably short and inaccurate meteorological memories, and always will magnify the importance of the events of the passing moment, and I feel I must utter a protest against the statement of a meteorological writer in a London daily newspaper who described the recent experience as the hardest November frost for a "generation." There is nothing very remarkable about frost and snow in the month of November, not much more, perhaps, than there is later on in the winter, inasmuch as the relatively small difference of some four to five degrees between the mean temperature of November and January (42°, November, 38°, January, approximately), is not so much a measure of a greater liability to the occurrence of a frost *spell* in January as of a some-

what lower general level of temperature operating through, as it were, any particular type of weather as it occurs. It is rare for a November to pass without a spell of severe weather in the northern portions of the kingdom, and in no month has the character of the bitter north wind with its portent of snow impressed me more vividly in the wild moors of the north of England. The great frost of December and January, 1890-91, commenced on November 25th, in the south of England, where heavy falls of snow occurred with maximum temperatures below freezing and minimum below 20° before the end of the month in London, whilst in Paris the thermometer fell to 5°, likewise before November was out.

L. C. W. BONACINA.

December 1st, 1915.

REVIEW.

Note on the Effects of Raingage Exposures. By W. G. REED (Reprinted from the *Monthly Weather Review*, U.S.A.) Washington, 1915. Size, 12 × 9½. Pp. 4.

So far as we are aware, comparatively little attention has been paid, outside this country, to the effect of exposure on the indications of rain gauges, and we read with pleasure of experiments, albeit not very conclusive, at the Meteorological Observatory of the University of California, at Berkeley. The area dealt with, about one square mile in extent, comprises the basin of the Strawberry Creek. On this small gathering ground, which varies in elevation from about 500 to 2,000 ft., thirteen rain gauges were erected in 1913 and 1914. The exposures varied greatly and none were good, but in some cases the gauges were more screened from wind eddies than in others. The gauges were read as a rule once or twice monthly, the average annual number of rain days at Berkeley being only 66. The method followed was to compare each reading with the mean value for the whole thirteen and to judge of the suitability of the exposure by the consistency of the results. The subject is one which bristles with difficulties and is complicated by the fact that the defects of exposure which appear at first to be the more trivial are often responsible for the most serious anomalies in the readings. We should for example, have been disposed to lay considerable stress on the variations in the heights of the rain gauges above ground, which we notice, varied from 8 inches to 22 inches, a factor of importance in wind-swept localities. It seems probable that no definite conclusions can be arrived at unless the individual measurements can be studied in their relation to the wind direction and velocity during the time when the rain is actually falling.

We hope that these observations will be continued, since a single year's results can hardly be regarded as sufficient. C.S.

ROYAL METEOROLOGICAL SOCIETY.

THE first meeting of the session was held on November 17th, at the Society's rooms, Major H. G. Lyons, F.R.S., President, in the Chair.

Mr. J. S. Dines, M.A., read a paper on "The Mounting and Illumination of Barometers and the Accuracy obtainable in the Readings." He discussed the relative accuracy of the Fortin Barometer and the Kew Barometer as exhibited by readings from two pairs of instruments and the probable magnitude of errors introduced by details in the method of reading. Mr. W. Marriott, Dr. C. Chree, Mr. F. J. W. Whipple, Mr. C. Harding, and Mr. W. W. Bryant took part in the discussion on the advantages and disadvantages of various methods of reading the standard instruments at present in use.

A paper by Mr. N. A. Comissopulos, of the Egyptian Meteorological Office, "On the Seasonal Variability of Rainfall over the British Isles," placed before the meeting by the Secretary, was based on the rainfall data provided in the recent paper on Isomeric Rainfall Maps, by Dr. H. R. Mill and Mr. Carle Salter, and suggested an alternative method of studying seasonal oscillation. The standard deviations and coefficients of variability ($\frac{\sigma}{1/12 A} \times 100$ where σ is the standard deviation and A the average annual rainfall, *i.e.*, the standard deviation expressed as a percentage of one-twelfth of the annual rainfall) were calculated from the monthly rainfall averages and a map was constructed showing lines of equal coefficients of variability. These formed in general a series of closed curves roughly equidistant from the coast lines. In addition the variability was correlated with both altitude, giving a coefficient of $-\cdot09 \pm \cdot05$, and with mean annual rainfall, giving $+\cdot40 + \cdot04$, showing that the latter only had any interdependence.

Dr. H. R. Mill, in welcoming Mr. Comissopulos' work, said that the map of variability expressed quantitatively what he and Mr. Salter had previously arrived at qualitatively in their map of the standard isomer. Mr. Salter pointed out that a single coefficient would not adequately express the character of a bi-phased curve and suggested that mathematicians might provide a formula for analysing the seasonal curves into their simple component curves in order to differentiate between the spring—autumn and the winter—summer oscillations.

Mr. C. E. P. Brooks commented on the fact that the minimum coefficient resulting from an absolute chance distribution was almost reached in the minima shown on the map. Dr. C. Chree and Messrs. W. H. Dines and F. J. W. Whipple also spoke.

The following were elected fellows of the Society :—Mr. T. N. N. Chettiar, Mr. Thomas Fox, Rev. K. D. McDonald, Lieut. W. R. Patterson, Mr. J. M. Whitting, Cadet F. S. R. Wilson-Holden.

RAINFALL TABLE FOR NOVEMBER, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·34	2·31
Tenterden	*Kent*	51 4	*0 41	190	3·07	3·35
Arundel (Patching)	*Sussex*	50 51	0 27	130	3·54	3·42
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	3·39	3·28
Oxford (Magdalen College)	*Oxfordshire*	51 45	1 15	186	2·25	2·08
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	2·22	2·21
Shoeburyness	*Essex*	51 31	*0 48	13	2·09	3·05
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·40	2·18
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·49	2·87
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	4·07	3·48
Rousdon [Lyme Regis]	,,	50 41	3 0	516	3·51	2·73
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·77	1·91
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·94	3·02
Boston	*Lincolnshire*	52 58	0 1	11	2·05	2·86
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	1·98	2·23
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·21	2·67
Macclesfield	*Cheshire*	53 15	2 7	501	3·00	1·81
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	3·16	2·14
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	6·12	3·83
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·34	1·83
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	2·34	2·51
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·63	1·75
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	13·59	5·91
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	4·08	3·04
Haverfordwest	*Pembroke*	51 48	4 58	90	5·16	3·49
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	4·50	3·88
Llandudno	*Carnarvon*	53 20	3 50	72	3·19	2·91
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·35	2·86
Marchmont House	*Berwick*	55 44	2 24	498	3·21	2·66
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	5·24	1·88
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·63	1·55
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	7·39	3·18
Mull (Quinish)	,,	56 34	6 13	35	6·24	3·00
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·62	1·59
Braemar	*Aberdeen*	57 0	3 24	1114	3·76	4·28
Aberdeen (Cranford)	,,	57 8	2 7	120	3·29	3·23
Gordon Castle	*Moray*	57 37	3 5	107	2·85	4·04
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	4·51	2·69
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	8·90	6·82
Dunrobin Castle	*Sutherland*	57 59	3 56	14	3·25	4·32
Wick	*Caithness*	58 26	3 6	77	2·95	3·78
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	5·54	5·23
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	3·80	2·88
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·88	5·09
Ennistymon House	*Clare*	52 57	9 18	37	4·62	4·99
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·41	5·22
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·28	2·72
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·64	3·67
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·38	2·48
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	5·75	4·62
Cong (The Glebe)	,,	53 33	9 16	112	5·00	4·66
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	4·02	3·70
Seaforde	*Down*	54 19	5 50	180	3·86	3·02
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·77	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·66	2·77

RAINFALL TABLE FOR NOVEMBER, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875—1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
— ·03	99	·69	11	9	22·98	26·54	+3·56	115	25·11	Camden Square
+ ·28	109	·67	12	14	24·87	27·64	+2·77	111	27·64	Tenterden
— ·12	97	·97	11	10	27·57	34·02	+6·45	123	30·48	Patching
— ·11	97	·90	11	13	28·64	34·46	+5·82	120	31·87	Cadland
— ·17	92	·86	11	8	22·52	24·97	+2·45	111	24·58	Oxford
— ·01	100	·89	12	10	23·07	20·47	—2·60	89	25·20	Swanspool
+ ·96	146	·75	11	12	17·57	21·39	+3·82	122	19·28	Shoeburyness
— ·22	91	·83	12	14	23·26	21·04	—2·22	90	25·40	Westley
+ ·38	115	·48	12	22	21·66	26·55	+4·89	123	23·73	Geldeston
— ·59	86	·75	9	15	33·81	36·84	+3·03	109	38·27	Polapit Tamar
— ·78	78	1·13	11	11	29·86	31·71	+1·85	106	33·54	Rousdon
— ·86	69	·80	11	11	27·10	27·73	+ ·63	102	29·81	Stroud
+ ·08	103	1·36	12	11	29·42	33·04	+3·62	112	32·41	Wolstaston
+ ·81	139	1·03	12	18	21·47	22·02	+ ·55	103	23·35	Boston
+ ·25	113	1·32	12	15	22·29	20·43	—1·86	92	24·46	Hodsock Priory
+ ·46	121	1·06	12	10	24·27	26·77	+2·50	110	26·65	Mickleover
—1·19	60	·49	9	8	31·38	29·10	—2·28	93	34·73	Macclesfield
—1·02	68	·45	12	11	29·60	25·61	—3·99	87	32·70	Southport
—2·29	63	1·55	12	11	54·74	42·92	—11·82	78	61·49	Arncliffe
— ·51	78	·85	12	6	24·60	23·23	—1·37	94	26·87	Ribston Hall
+ ·17	107	1·16	12	21	24·10	22·85	—1·25	95	26·42	Hull
— ·88	67	·63	12	17	25·48	19·87	—5·61	78	27·94	Newcastle
—7·68	43	2·30	9	9	114·34	82·41	—31·93	72	129·48	Seathwaite
—1·04	75	1·33	11	16	37·58	31·92	—5·66	85	42·28	Cardiff
—1·67	68	1·29	11	13	41·63	39·79	—1·84	96	46·81	Haverfordwest
— ·62	86	1·50	11	13	40·80	37·00	—3·80	91	45·46	Gogerddan
— ·28	91	1·21	12	12	27·52	27·02	— ·50	98	30·36	Llandudno
—1·49	66	1·07	8	9	38·63	36·88	—1·75	95	43·47	Cargen
— ·55	83	·44	29	17	30·93	26·82	—4·11	87	33·76	Marchmont
—3·36	36	·65	8	12	44·29	37·62	—6·67	85	49·77	Girvan
—2·08	43	·40	8,27	7	32·02	23·83	—8·19	74	35·97	Glasgow
—4·21	43	1·08	8	11	60·10	49·99	—10·11	83	68·67	Inveraray
—3·24	48	1·11	8	18	49·98	37·35	—12·63	75	56·57	Quinish
—1·03	61	·82	29	9	25·97	23·89	—2·08	92	28·64	Dundee
+ ·52	114	2·29	9	12	31·80	36·35	+4·55	114	34·93	Braemar
— ·06	98	·78	29	16	29·30	29·65	+ ·35	101	32·73	Aberdeen
+1·19	142	1·86	9	20	27·62	32·25	+4·63	117	30·34	Gordon Castle
—1·82	60	1·09	9	18	38·91	28·29	—10·62	73	44·53	Fort Augustus
—2·08	77	1·21	30	18	74·07	62·80	—11·27	85	83·93	Bendamph
+1·07	123	1·00	9	17	28·81	27·47	—1·34	95	31·90	Dunrobin Castle
+ ·83	128	...	...	...	26·77	21·87	—4·90	82	29·88	Wick
— ·31	94	1·27	11	15	47·89	44·32	—3·57	93	54·81	Killarney
— ·92	76	·99	11	9	35·25	34·53	— ·72	98	39·57	Waterford
+1·21	131	2·19	11	12	35·09	35·63	+ ·54	102	39·43	Castle Lough
+ ·37	108	1·73	11	14	41·49	41·31	— ·18	100	46·52	Ennistymon
+1·81	153	2·21	12	8	31·57	33·45	+1·88	106	34·99	Courtown Ho.
— ·56	83	·95	11	13	32·51	30·88	—1·63	95	35·92	Abbey Leix
+1·03	139	1·59	12	10	25·41	28·67	+3·26	113	27·68	Dublin
— ·90	73	·95	12	9	32·76	35·68	+2·92	109	36·15	Mullingar
—1·13	80	·72	26	21	46·76	44·58	—2·18	95	52·87	Enniscoe
— ·34	93	1·28	11	16	43·48	42·03	—1·45	97	48·90	Cong
— ·32	92	·78	9	17	38·37	39·11	+ ·74	102	42·71	Markree
— ·84	78	·88	12	11	35·14	32·97	—2·17	94	38·91	Seaforde
...	...	...	...	...	33·69	...	...	...	37·56	Dundarave
— ·89	76	·65	29	16	35·47	33·24	—2·23	94	39·38	Omagh

SUPPLEMENTARY RAINFALL, NOVEMBER, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	3·66	XI.	Lligwy	3·09
,,	Ramsgate	3·30	,,	Douglas	4·24
,,	Hailsham	4·06	XII.	Stoneykirk, Ardwell House...	1·51
,,	Totland Bay, Aston House...	2·60	,,	Carsphairn Shiel	4·93
,,	Stockbridge, Ashley..	2·63	,,	Beattock, Kinnelhead	3·35
,,	Grayshott	3·40	,,	Langholm, Drove Road	2·60
III.	Harrow Weald, Hill House...	2·20	XIII.	Meggat Water, Cramilt Lodge	2·39
,,	Caversham, Rectory Road ...	1·94	,,	North Berwick Reservoir.....	1·28
,,	Pitsford, Sedgebrook....	2·60	,,	Edinburgh, Royal Observaty.	1·00
,,	Woburn, Milton Bryant.....	2·39	XIV.	Maybole, Knockdon Farm ...	1·42
,,	Chatteris, The Priory..... ...	2·67	XV.	Ballachulish House	3·94
IV.	Elsenham, Gaunts End	2·44	,,	Campbeltown, Witchburn ..	3·56
,,	Colchester, Hill Ho., Lexden	2·08	,,	Holy Loch, Ardnadam.....	4·17
,,	Ipswich, Rookwood, Copdock	1·98	,,	Islay, Eallabus	3·08
,,	Blakeney.....	3·14	,,	Tiree, Cornaigmore	3·80
,,	Swaffham	2·89	XVI.	Dollar Academy	2·61
V.	Bishops Cannings	2·03	,,	Balquhidder, Stronvar.....	...
,,	Wimborne, St. John's Hill ...	3·50	,,	Glenlyon, Meggernie Castle..	2·58
,,	Ashburton, Druid House.....	4·09	,,	Blair Atholl	3·31
,,	Cullompton	2·50	,,	Coupar Angus	2·07
,,	Lynmouth, Rock House	3·87	,,	Montrose, Sunnyside Asylum.	1·85
,,	Okehampton, Oaklands.. ...	3·37	XVII.	Alford, Lynturk Manse	3·79
,,	Hartland Abbey.....	2·89	,,	Fyvie Castle	4·41
,,	Probus, Lamellyn.....	2·47	,,	Keith Station	6·19
,,	North Cadbury Rectory.....	2·32	XVIII.	Rothiemurchus	3·92
VI.	Clifton, Pembroke Road.....	1·98	,,	Loch Quoich, Loan	5·80
,,	Ross, The Graig	1·63	,,	Drumnadrochit..... ..	4·40
,,	Shifnal, Hatton Grange.....	2·30	,,	Skye, Dunvegan	4·48
,,	Droitwich.....	2·18	,,	Lochmaddy, Bayhead	2·41
,,	Blockley, Upton Wold.....	2·34	,,	Glencarron Lodge	4·98
VII.	Market Overton.....	3·15	XIX.	Invershin	3·36
,,	Market Rasen	2·43	,,	Melvich	4·34
,,	Bawtry, Hesley Hall	2·38	,,	Loch Stack, Achfary	6·07
,,	Derby, Midland Railway.....	2·66	XX.	Dunmanway, The Rectory ..	5·76
,,	Buxton	2·96	,,	Glanmire, Lota Lodge.....	4·15
VIII.	Nantwich, Dorfold Hall	3·05	,,	Mitchelstown Castle.....	3·30
,,	Chatburn, Middlewood	2·21	,,	Darrynane Abbey.....	5·11
,,	Lancaster, Strathspey	1·94	,,	Clonmel, Bruce Villa	3·52
IX.	Langsett Moor, Up. Midhope	3·19	,,	Newmarket-on-Fergus, Fenloe	3·74
,,	Scarborough, Scalby	3·34	XXI.	Laragh, Glendalough	...
,,	Ingleby Greenhow	3·18	,,	Ballycumber, Moorock Lodge	2·18
,,	Mickleton	2·20	,,	Balbriggan, Ardgillan	2·70
X.	Bellingham, High Green Manor	1·47	XXII.	Ballynahinch Castle.....	6·73
,,	Ilderton, Lilburn Cottage ...	2·41	,,	Woodlawn	3·52
,,	Keswick, The Bank.....	2·47	,,	Westport, St. Helens	5·06
XI.	Llanfrechfa Grange	2·93	,,	Dugort, Slievemore Hotel ...	3·82
,,	Treherbert, Tyn-y-waun	5·74	,,	Mohill Rectory	2·80
,,	Carmarthen, The Friary	4·26	XXIII.	Enniskillen, Portora.....	1·96
,,	Fishguard, Goodwick Station.	3·11	,,	Dartrey [Cootehill]	1·98
,,	Crickhowell, Tal-y-maes.....	4·60	,,	Warrenpoint, Manor House ..	2·95
,,	New Radnor, Ednol	2·80	,,	Banbridge, Milltown	1·79
,,	Birmingham WW., Tyrmynydd	5·63	,,	Belfast, Cave Hill Road	2·45
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	3·66
,,	Llangynhafal, Plâs Draw.....	4·28	,,	Londonderry, Creggan Res...	3·21
,,	Dolgelly, Bryntirion.....	4·61	,,	Dunfanaghy, Horn Head ...	3·46
,,	Bettws-y-Coed, Tyn-y-bryn...	4·48	,,	Killybegs	3·58

THAMES VALLEY RAINFALL. —— NOVEMBER 1915.

Symons's Meteorological Magazine

Watershed of River Thames above Teddington, and River Lee above Feildas Weir

Rainfall Stations reporting Isohyetals

THE WEATHER OF NOVEMBER.

THE month of November was remarkable throughout the British Isles for a persistently low temperature and an abnormal range of pressure. In many places the month was the coldest November on record. At Chellaston, Derbyshire, the mean temperature was 34°·9, or 7°·3 below the average, and at Biggar the mean temperature was 31°·1. The general deficiency was about 5°. Sunshine was almost everywhere abundant and much in excess of the average; rainfall was generally deficient. The greater part of the month's total fell in the earlier half, when gales and stormy weather were experienced.

At the close of October a well marked cyclone passed up the English Channel, and lay for the first few days of November over Northern Europe. North-easterly winds with considerable sunshine were experienced, except in the south-east, where cloud and rain prevailed. From the 5th a cyclone developed off the coast of Norway and moved south-west until the 9th, when it had its centre over Scotland. Warmer weather resulted and the majority of stations recorded their maximum temperature for the month from 6th to 9th. These were, however, generally much below the normal and in many cases barely exceeded 50°. In the south the temperature was higher; at Cadland 60° was reached on the 9th, and at North Cadbury 59° on the 8th. In the north of Scotland there was heavy rain and some snow, Drumnadrochit recording 1·20 in. and 2·14 in. on the 8th and 9th. On the 11th a deep cyclone developed off the west of Ireland and became the predominating influence. Unsettled conditions resulted, culminating in gales and heavy rain from the 11th to 13th. In the north precipitation was frequently in the form of snow. On the 11th and 12th heavy rain was general in the south and west, the greatest falls being recorded in Ireland. The rainfall for these two days at Doolin, Co. Clare, was 5·08 in. At Clonmannon, Co. Wicklow, on the 12th, the fall was 2·37 in., and the gale which accompanied it was the worst north-easter experienced there since 1861. Gusts of wind were recorded in the south and west districts reaching a velocity of over 80 miles per hour. More settled anticyclonic conditions followed with abundant sunshine, moderate winds from the north and very low temperatures. These conditions were maintained with little change until almost the end of the month. Minima below 20° were recorded in most districts; on the 17th and 18th the temperature fell to 9° at Biggar. On the 15th snow was general, except in the extreme south. Thence to the 29th slight falls of rain and snow in most parts prevented the occurrence of an absolute drought, except in the south of Ireland, where no precipitation was recorded from 14th to 28th inclusive at several stations. The last two days of the month were again generally wet and stormy with an increase in temperature and south-west winds. Thunderstorms occurred in the south with hail and squalls.

The rainfall of the month was in excess of the average over three areas: the north-east of Scotland, a central strip in Ireland from west to east, and in the north Midland counties of England, with a coastal fringe from Flamborough Head to Kent. The deficiency was most marked on the west coast of Scotland and the extreme north-west of England, where less than half the average was recorded. Broadly the wettest parts had the smallest percentage of the average, the distribution being comparatively uniform. Over the Kingdom as a whole the general rainfall expressed as a percentage of the average was: England and Wales, 82; Scotland, 74; Ireland, 97; British Isles, 83.

The following sunshine records were reported: Camden Square, 60 hours; Worthing, 120 hours; Totland Bay, 112 hours; Copdock, 77 hours; Sidmouth, 97 hours; Weymouth, 109 hours; Ashbourne, 76 hours; Southport, 84 hours; Bolton, 32 hours; Hull, 56 hours; Haverfordwest, 115 hours; Swinton, 52 hours; Paisley, 49 hours; Perth, 76 hours; Loch Stack, 36 hours.

In London (Camden Square), the mean temperature was 39°·2, or 4°·3 below the average, being the coldest November, with three exceptions, since 1858. Duration of rainfall, 47·4 hours. Evaporation, ·25 in.

Climatological Table for the British Empire, June, 1915.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
								0-100			inches		
London, Camden Square	88°9	8	41°8	1	72°9	51°0	52°4	76	133·6	37°5	·69	8	5·2
Malta	84·2	21	66·0	6	77·6	69·1	...	90	140·0	...	1·36	8	1·6
Lagos	89·0	4	70·0	13	85·0	74·5	74·3	84	155·0	67·0	24·95	25	8·8
Cape Town	81·9	12	41·3	20	63·8	49·4	50·3	78	...	...	5·92	14	5·5
Natal, Durban ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius	80·1	4	57·2	‡27	76·1	62·6	61·3	76	...	47·9	1·00	14	5·4
Bloemfontein	71·7	5	21·2	20	61·8	32·7	32·5	70	..	...	·02	1	2·3
Calcutta...	95·0	8	74·3	1	91·2	79·4	78·2	83	...	70·2	10·64	14	8·1
Bombay...	94·2	17	76·4	27	89·5	81·1	77·2	78	135·7	67·2	40·10	13	6·1
Madras	106·3	1	76·8	24	98·3	82·6	74·1	67	159·6	74·6	1·31	8	5·0
Colombo, Ceylon ...	91·4	4	72·5	16	87·7	77·6	74·7	81	153·7	69·7	7·96	21	7·6
Hongkong	91·0	27	73·6	13	86·2	78·4	76·0	83	...	...	11·96	19	7·9
Sydney	67·2	5	42·1	27	62·3	48·1	44·3	66	116·3	40·2	1·33	5	4·4
Melbourne	65·1	2	38·5	26	56·8	46·5	43·4	72	102·0	28·8	2·08	20	7·7
Adelaide	72·7	1	42·6	8	61·2	50·2	48·5	75	121·2	33·3	3·40	15	6·8
Perth	70·1	9	44·6	27	64·8	53·5	52·7	80	129·3	39·0	8·07	23	7·5
Coolgardie	70·8	4	36·6	9	63·0	47·4	45·3	69	125·6	30·4	3·07	11	6·5
Hobart, Tasmania ..	63·3	2	33·9	26	53·2	41·1	38·3	68	106·0	26·3	1·57	23	5·9
Wellington	60·8	13	31·2	20	54·9	44·4	43·9	80	112·6	23·0	2·37	16	8·1
Auckland	66·0	13	42·0	14	59·4	48·2	49·5	85	118·0	37·0	4·48	21	6·2
Jamaica, Kingston ..	94·3	27	71·9	29	89·5	74·6	73·0	76	...	...	14·51	9	...
Grenada	89·0	*21	72·0	8, 14	86·0	74·0	...	77	135·0	...	4·62	23	4·5
Toronto	82·0	29	42·9	24	73·1	51·3	50·3	68	137·6	40·8	1·34	13	4·7
Fredericton	81·8	5	31·0	3	71·7	47·1	...	78	...	...	5·44	16	5·7
St. John, N.B. ...	73·7	6	38·5	2	62·9	48·3	49·5	79	...	...	5·97	15	6·4
Alberta, Edmonton ...	75·6	†23	33·1	14	66·2	45·1	...	68	139·0	26·3	6·42	19	5·7
Victoria, B.C.	82·5	30	47·9	24	65·2	50·5	...	74	142·0	39·2	·61	4	3·7
			*22.		†24.		‡28.						

MALTA—Three or four TSS, which is exceptional.

Mauritius—Mean temp. 0°·6 above, and R 1·58 in. below, averages. Mean hourly velocity of wind 1·28 miles below average.

COLOMBO, CEYLON—Mean temp. 82°·7, or 0°·9 above, dew point 0°·2 below, and R ·25 in. below, averages. TSS on three days.

HONGKONG—Mean temp. 81°·6, mean hourly velocity of wind 8·0, and bright sunshine 175·9 hours.

Melbourne—Mean temp. 1°·2 above, and R normal.

Adelaide—Mean temp. 2°·3 above and R ·37 in. above, averages.

Perth—R generally above the average.

Coolgardie—Temp. 2°·7 above, and R about two inches above, averages.

Hobart—Temp. 1°·1 above, and R ·61 in. below, averages.

Wellington—Mean temp 0°·2 above, and R 2·71 in. below, averages. Bright sunshine 79·8 hours. T, L, and H on 18th. Fog on three mornings.

Auckland—R close to average.

ALBERTA, EDMONTON—Great flood on 29th, the river Saskatchewan rising 28 ft. in 36 hours, 45 ft. 2 in. above low water level, doing great damage. TSS on 8 days.

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Meteorological Magazine.

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THE RAINFALL OF 1915.

A PRELIMINARY study of the rainfall of 1915 shows that the south of England was again the wettest part of the British Isles in relation to the average. In the south-eastern counties more than 130 per cent. of the average fell. Another wet band, with maxima over 120 per cent., stretched across the English midlands. In respect of the great wetness of the southern counties it is noteworthy that this has been a feature of every year since 1909. In the north-west, from the southern Pennines to the West Highlands, the rainfall was below the average, less than 90 per cent. of the average falling over the greater part of this large area and less than 80 per cent. in the west of Scotland. In the north-east, on the other hand, the rainfall was above the average, especially in the north-eastern counties of Scotland, where a large area had an excess of more than 20 per cent. The distribution of rainfall in Ireland was more simple, there being a moderate excess in the centre and south-east reaching a maximum of 20 per cent. at Dublin and a slightly deficient fall in the south-west, west and north.

The wettest months of 1915 were, with the exception of July, in the winter. February and December showed the most marked excesses, particularly in England and Wales. With local exceptions every month from March to November inclusive, except July, had less that its normal rainfall. The dryness of the spring months was in most cases rather partial, March being driest in the north-west, April in the east, and May in the north-west. June was also very dry in the north of Scotland. The most pronounced droughts however occurred in the autumn, and considerable areas, especially in the west of Scotland and the north-west of England, had a serious deficiency of rainfall every month from August to November inclusive. The north-east of Scotland on the other hand experienced several unusually heavy cyclonic rainfalls during the autumn.

The general rainfall of 1915 as deduced from 130 records uniformly distributed over the British Isles was as follows :—

England, South.	England, North.	Wales.	Scotland.	Ireland.	British Isles.
119	97	104	93	102	102 per cent. of average.

Frederic Gaster.

1842—1915.

It is with much regret that we record the death at Whitstable, on September 10th, of Frederic Gaster, who for upwards of 50 years had been a Fellow of the Royal Meteorological Society. He was a member of the staff of the Meteorological Department of the Board of Trade, and subsequently of the Meteorological Office, when in 1867 the "Department" changed its name on passing from the control of the Board of Trade to that of a Committee nominated by the Royal Society, and presided over by Sir Edward Sabine, F.R.S. At first Gaster acted as Assistant to Mr. R. Strachan, F.R.Met.Soc., who, happily, still survives; but soon after the death of Admiral FitzRoy, in 1865, the Storm-warnings and Weather-forecasts originated by him in 1861 were discontinued, and when in response to the strong public agitation which followed immediately after their suppresssion they were resumed, Mr. Gaster was placed in charge of that department of the Office, at the head of which was Mr. R. H. Scott, F.R.S., and this position he retained until his retirement in 1909.

During that long interval many developments and much progress in the science of Weather-forecasting took place, in all of which it is but fair to say Gaster had a most important share. Indeed, as a "Weather Expert," to use a term which has become somewhat familiar now in the newspapers, he acquired great skill in predicting the sequence of weather which would ensue upon the conditions shown on the synoptic charts, drawn from the data telegraphed to the Office twice or thrice a day, and this skill had a scientific as well as an empirical basis. The reality of the progress is authenticated by the results of the systematic checking of the forecasts made in the Office, and published in its Annual Reports, where a fairly steady increase is shown, year by year, in the percentage of "Successes," and a corresponding diminution in the "Failures."

In addition to his official work Mr. Gaster contributed during many years the weather articles which appeared regularly in the *Times*, for the production of which his unique knowledge of what was taking place not only in British, but also in European weather, eminently fitted him.

At one time his was a very familiar figure at the meetings of the Meteorological Society, for which he wrote a few papers, and at which he used frequently to take part in the discussions; but for some years prior to his retirement from the Meteorological Office his attendance was only occasional, and to most of those who now attend the meetings he was by no means so well known as he was to those who frequented them a quarter of a century ago. R.H.C.

ROYAL METEOROLOGICAL SOCIETY.

An ordinary meeting was held on December 15th, at the Society's Rooms, Westminster, Major H. G. Lyons, President, in the Chair.

Mr. F. J. Brodie read a paper on "The Incidence of Bright Sunshine over the United Kingdom during the 30 years, 1881-1910." The author described the evolution of the Campbell-Stokes recorder, which is now accepted as the standard instrument for sunshine observations. The essential features of the instrument had changed little since the improvements introduced by Sir George Stokes in 1879; and the records since 1880, the first year of publication in the *Weekly Weather Report*, might, therefore, be accepted as homogeneous. At the close of the decade ending with 1910, the total number of stations reporting to the Meteorological Office and the Society had reached 198. In discussing the average distribution the data from 66 stations were utilized, and maps constructed showing the seasonal and annual incidence. The broad features of the distribution, differing little from the map of the average sunshine, previously published in *Symons's Meteorological Magazine* (volume **42,** face p. 150), showed an increase from north to south, with a tendency to coastal maxima and inland minima; and there was ample confirmation, even ignoring the records of the large manufacturing towns, for the area of small sunshine over the central parts of northern England. A special examination of the records in London and other manufacturing centres, showed the marked deficiency resulting from smoke, more particularly in the winter months. There was evidence, however, that the abatement of the smoke evil had somewhat remedied these conditions in recent years. In conclusion some references were made to individual examples of sunny days and weeks, and the relation of the recorded duration to the duration theoretically possible.

Col. Mellish compared the parallelism between isonephs and isohels which gave an interesting example of the importance of taking into consideration the geographical positions of the sunshine stations. At Fort Augustus the sheltered position in the Great Glen considerably reduced the duration of sunshine, an irregularity not reproduced in cloud observations.

Dr. Chree emphasized the great importance of absolutely standard instruments, especially in the uniformity of sensitiveness in the cards employed.

Mr. W. W. Bryant criticised the seasonal grouping employed by Mr. Brodie, who, following the usual practice, placed May amongst the spring months; he (Mr. Bryant) considered that with its intimate relation to the sun's altitude the seasonal arrangement of sunshine records should place May amongst the summer months. Messrs. R. H. Hooker, J. E. Clark, C. Harding, and Sir Napier Shaw also spoke.

Dr. W. Galloway gave a scientifically exact description of remarkable cloud phenomena seen by him on July 31st, 1915, from the Norfolk Broads. The phenomena, which took place in the zenith, were apparently of the nature of electrical discharges between two clouds, and were aptly compared in appearance to the movements of a pollen tube when fructifying.

Sir Napier Shaw suggested that the position of the phenomena in the zenith, where observations were comparatively rare, might in some degree account for their remarkable appearance, and instanced some sketches he had received of cloud formations viewed more nearly horizontally, which to a certain extent resembled those described by Dr. Galloway.

Mr. Tripp and Dr. C. Chree also spoke.

The following were elected fellows of the Society: Mr. R. A. Watson Watt, B.Sc., and Mr. John White.

SCOTTISH METEOROLOGICAL SOCIETY.

The Annual Business and General Meeting of the Society was held on 21st December, 1915, in the Goold Hall, Edinburgh, Mr. J. Mackay Bernard, President, in the Chair.

The Report from the Council stated that the routine work of the Society had proceeded much on the usual lines, though difficulties inseparable from war conditions had arisen. As regards the observation of rainfall there were still large areas in the Highlands and North of Scotland for which no information was available, and though perhaps at present no great extension of the existing network of stations need be looked for, the Council were of opinion that a responsibility rested on local authorities to secure adequate representation of the areas under their control. There had, unfortunately, been a considerable shrinkage in the membership of the Society, owing mainly to the deaths of supporters of long standing.

Mr. George Williamson moved the adoption of the Report, which involved the retirement by rotation of Mr. J. Mackay Bernard from the Presidentship, after a three years' term of office. The following Council and Office-bearers were elected for the ensuing twelve months:

President: Prof. R. A. Sampson, D.Sc., F.R.S., Astronomer-Royal for Scotland; *Vice-Presidents:* Messrs. C. T. R. Wilson, F.R.S., and A. Crichton Mitchell, D.Sc.; *Council:* Messrs. T. S. Muir, C. G. Knott, D.Sc., James Watt, W.S., Sir R. P. Wright, F.R.S.E., Prof. T. Hudson Beare, J. D. Falconer, D.Sc., J. Mackay Bernard, M. M'Callum Fairgrieve, D. A. Stevenson; *Hon. Sec.:* E. M. Wedderburn, W.S., D.Sc.,; *Hon. Treasurer:* W. B. Wilson, W.S.

The retiring President, Mr. Bernard, under the title of "Some Remarks on Meteorology," discussed a wide variety of topics, amongst others the physical processes underlying the formation of rain; the problems of forecasting; the appearance of the sky as a weather prognostic, and some other popular points of view; the rain-band spectroscope; and various types of weather glasses. Examples were given, of the usefulness of a Central Office as a bureau where inquiries of a purely practical nature could be dealt with. Reference was made to the oldest known weather records, and the lecturer had examined a large mass of Scottish material. Two interesting examples of weather extremes were cited. Thus, the winter of 1614-15 was so severe and so prolonged and the destruction of live stock so great, that the use of lamb as a food was prohibited by law for a certain time. Again in 1652 a wonderfully dry and warm summer was experienced, with the harvest completed in parts of Scotland early in July. "The summer produced ripe wine berries and grapes and abundance of Scotch chestnuts openly sauld at the Mercat Cross of Edinburgh and baken in pasties at banquets." The fine weather of 1652 lasted far on in the year, so that fruit trees blossomed and fruited again a second time and "salads and sybous were cried and sold in Edinburgh on the 27th of November."

Mr. Bernard was cordially thanked for his services as President, and for his paper. Professor Sampson, Dr. Knott, and Messrs. T. S. Muir, A. Watt, G. Williamson, and W. B. Wilson took part in an interesting discussion.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

LURID SUNSET AS A PROGNOSTIC.

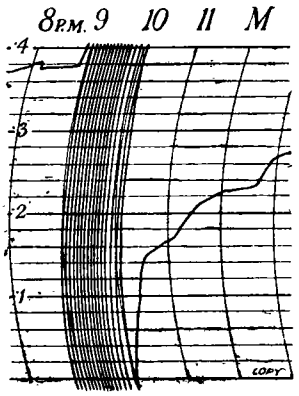
On Thursday, November 25th, there was a magnificent sunset. As the sun was setting a lurid red glow was succeeded by a deep purple —the sky presenting the appearance of an impending thunderstorm. A friend of mine has seen similar sunsets in Ceylon, and at Trondhjem, and they are regarded as a sign that very bad weather will follow. Can any of our readers throw any information as to whether this is so?

W. SIMPSON.

24, Rectory Road, Caversham, December 2nd 1915.

HEAVY RAIN IN COLOMBO.

I ENCLOSE herein copies of records from the pluviographs at the Observatory and the Surveyor General's Office (Fort) of the heavy rain experienced in Colombo in the early hours of the morning of 28th October. It will be seen that the maximum intensity is nearly the same for both, about 6 inches in the hour. The third record that of 12th July, 1907, is from the Surveyor General's Office (Fort), and shows the record for one shower as far as Colombo is concerned. Here it will be noted that 6 inches of rain fell practically within the hour.



COLOMBO OBSERVATORY, 12-13 JULY, 1907

The pluviograph at the Fort is on the roof of the Surveyor General's Office at a height of 50 feet above ground level, and the indications are that on account of altitude the reading of the gauge should be increased 20 per cent. to arrive at the correct rainfall at ground level. Through retrenchment it is quite impossible to purchase pluviographs of the Richard pattern, but records from some of Ceylon's really wet places would be interesting.

J. E. EVANS,

for Superintendent Observatory, for Surveyor General.

Colombo Observatory, Ceylon, 4th November, 1915.

[The two charts from Richard's Pluviographs, referred to above, are reproduced as the frontispiece to this volume. The greatest fall of rain on record in one hour approaches 12 inches, but falls of 6 inches in an hour are extremely remarkable.—Ed. *S.M.M.*]

THE RAINFALL OF HAVANA AND ENGLAND, S.W.

IN 1914 the Havana rainfall during the wet season was 29 per cent. below the average, which suggested (see p. 14) that the fall in England, South-west, January to March, 1915, should be in excess of the average. The official figures published in May, 1915, give the rainfall for that district as 29 per cent. above the average. The exact coincidence is remarkable.

The figures for Havana, May to October, 1915, have now come to hand, and show the rainfall for the season as only 82 per cent. of the usual fall. This again indicates, on the strength of the correlation coefficients, a wet season in England, South-west, for January to March, 1916. It will be interesting to see whether the parallelism proves as marked this year as last.

December 30th, 1915. A. HAMPTON BROWN.

WINTER THUNDERSTORMS.

BEING engaged on some investigations of Thunderstorms, I should like to ask readers of *Symons's Meteorological Magazine* if they would assist by sending me a note of any thunderstorms they may observe up to the end of March, 1916. The comparatively rare thunderstorms of winter are particularly useful in my investigations; but thunderstorms being often very local may be missed by the official Observers. Therefore rainfall Observers could assist very much if they would send me a postcard—(1.) when they notice sheet lightning at night; the time should be given, the direction in which seen, and whether there were many flashes or only two or three; (2.) when they hear thunder; the time should be given and the direction of the storm, and a note as to whether lightning was seen and whether rain occurred. These are the principal points on which information is required, but any further details of the storm would be useful. After the end of March thunderstorms become too common to be treated in this way, so I only ask for information up to March 31st, 1916.

CHARLES J. P. CAVE, *Capt.*

Meteorological Office, South Farnborough, Hants, December 9th, 1915.

A "PARTIAL RAIN-SPELL."

MR. A. E. Swinton, in your Magazine for September last (p. 130), suggests the term "partial rain-spell," defining it: "A partial rain-spell is a period of more than 28 consecutive days in which there were never more than two consecutive days without rain." This definition might possibly, though not probably, lead to a *reductio ad absurdum*, for such a partial rain-spell might also be a partial drought, if the falls of rain were very small. It would be so if they did not aggregate ·29 in. in 29 days. The term, I agree with Mr. Swinton, would be useful, but it should be confined to exceptional periods of wet weather, the amount as well as frequency of the rain being taken into consideration. I would, therefore, suggest the definition: "A partial rain-spell is a period of more than 28 consecutive days with an average rainfall of at least ·10 in. per day and without two consecutive rainless days." This practically confines the term to a period in which at least three inches of rain fell.

Within the last two years we have had here such a period three times: March 1st to 30th, 1914, 30 days with 4·85 in. of rain falling on 27 days; November 14th, 1914, to January, 16th, 1915, 64 days with 11·45 in. of rain on 45 days; and November 29th to December 27th, 1915, 29 days, with 5·84 in. of rain on 25 days.

JOHN HOPKINSON.

Weetwood, Watford, 29th December, 1915.

THE FIRST LONDON BAROMETER.

In reading "The Lives of the Norths," by Roger North, lately, I came across the following passage relating to the early history of the barometer, which I think may be of interest to your readers. It occurs in the life of Lord Guildford, Lord Keeper in the last years of Charles II., volume II., pp. 202, ff. ed. of 1826. No dates are given in the work from beginning to end, but it may be taken as referring to the period between 1670 and 1680. The passage is as follows: "His lordship was much affected by the discoveries which fell in the consequences of the Torricellian experiment: whereby a new world of air, compressing everything it touches, is revealed. He could not but observe a manifest connexion between the alterations of the mercurial station, and the course of the winds and weather; but could not fix in his mind any certain rules of indication, but rather the contrary, viz., that events failed as often as corresponded with the ordinary expectation. But yet he would not give it over for desperate, and hoped that a more general observation might generate a better prognostic of the weather from it, than was yet known. And that must be expected from a more diffused, if not an universal use of it, which could not then be thought of; because the instruments were rare, and confined to the cabinets of the virtuosi; and one was not to be had but by means of some of them. Therefore his lordship thought fit to put some ordinary tradesmen upon making and selling them in their shops; and accordingly he sent for Jones, the clock maker in Inner Temple Lane; and having shown him the fabric, and given him proper cautions in the erecting of them, recommended the setting them forth for sale in his shop; and, it being a new thing, he would certainly find customers. He did so, and was the first person that exposed the instrument to sale publicly in London. . . . . Then others took it up, and few clock makers, instrument makers, cabinet makers and divers other trades were without them always in their shops, ready for sale."

A page or two earlier (197) there is a curious account of an instrument made by Sir Samuel Moreland, and called by him a "statick barometer"; "and he defied all the virtuosi to resolve it." The description is minute and detailed, but baffles my comprehension. Perhaps some of your more scientific readers might find amusement in working it out.

G. SEARLE.

COLD NOVEMBERS AND SEVERE WINTERS.

Here the mean temperature of November, 1915, was 38°·5, or nearly 5° below the average. It occurred to me to examine previous records of temperature in order to trace whether a severe winter usually follows a frosty November. I give a table in which the values are selected from the Greenwich records, viz., Belville's

1812-48, and those tabulated in Greenwich Meteorological Observations, Parts III. and IV., 1849-1905.

	Cold November.	Dec., Jan. and Feb. following.			Cold November.	Dec., Jan. and Feb. following.		
Year.	Mean Temp.	Mean Temp.	Diff. from average 1841-1905.	Year.	Mean Temp.	Mean Temp.	Diff. from average 1841-1905.
	°	°	°		°	°	°
1812 ...	40·3	37·0	—2·3	1854 ...	40·6	35·1	—4·2
1813 ...	40·3	31·9	—7·4	1858 ...	39·5	41·7	+2·4
1815 ...	38·7	36·3	—3·0	1862 ...	39·8	42·7	+3·4
1816 ...	39·1	40·6	+1·3	1871 ...	37·4	41·6	+2·3
1819 ..	40·9	34·8	—4·5	1878 ...	39·8	34·6	—4·7
1826 ...	40·5	36·3 ..	—3·0	1879 ...	38·5	36·0	—3·3
1829 ...	39·4	33·2 ...	—6·1	1887 ...	40·8	37·1	— 2·2
1837 ...	40·8	34·4 ...	—4·9	1896 ...	40·5	39·3	0·0
1851 ...	37·7	41·1 ...	+1·8	1910 ...	38·6	41·4	+2·1
				Averages	43·5	39·3	

Thus in 11 cases cold winters succeeded cold Novembers, while in only 6 instances mild seasons ensued. I am not in possession of the Greenwich temperatures since 1905, but have appended the figures for 1910-11, from Camden Square, which prove that a frosty November preceded a warm winter, and it is notable that before the very severe winter of 1895, we had an unusually mild November !

In the "Annuaire Astronomique," by Camille Flammarion, I consulted the "Temperatures mensuelles et annuelles relevées a l'Observatoire de Paris," from 1801 to 1914, with a view to extending this enquiry. I found, however, that in a decided majority of cases (9 to 4), a frosty November ante-dated a warm winter. To what extent local conditions may have induced different results for Greenwich and Paris I cannot say. The discordances in monthly temperatures were often considerable, thus at Greenwich, in November, 1910, the weather was much colder than in November, 1909, whereas at Paris by far the colder month was November, 1909. It is sufficiently obvious from these inconsistencies revealed from my extremely partial enquiry, that the character of a coming winter cannot be safely foretold from the weather of a prior November. W. F. DENNING.

Bristol, December 15th, 1915.

THE NOVEMBER FROST.

THE mean temperature of November, 1915, in this district, was 33°·06, and apart from the single instance of January, 1908, with a mean of 33°·00, there has been no month with a lower temperature since February, 1902, 31°·7. The mean minimum was 24°·5 (instrument unscreened and four feet above ground on post), and this works out as colder than the mean monthly minimum of any month since February, 1900 (22°·2). No November in the last sixteen years shows a lower mean minimum than 27°·3, in 1910.

Prior to 1900 my observations do not show the means, only the extremes. The mean maximum for November was 41°·6, which is the lowest November maximum in my observations, back to 1900, the nearest approach to it being 42°·5 in 1910. The absolute minimum was 11° on 27th. There were 23 frosts and the maximum failed to reach 40° on twelve days, and on one of these days (27th), failed to reach 32°.

The frost seems to have been still more severe in Scotland. An interesting article on the sudden migration of grouse owing to the cold and snow appeared in *The Field* of December 11th. There it is stated that seldom within the memory of man has such a severe November been experienced in Scotland. Skating on the Tweed and Nith was general, on pools where a week previous the salmon angler had been throwing his fly.

Near Preston skating was indulged in as early as November 18th, and the friend who told me said it was the earliest date in his recollection, and continued for ten days, an unprecedented circumstance.

R. P. DANSEY.

Kentchurch Rectory, Hereford, December, 1915.

REVIEWS.

Memoirs of the Indian Meteorological Department, Vol. XXI.' Part X., Correlation in Seasonal Variations of Weather. IV.' Sunspots and Rainfall. By Dr. G. T. Walker, C.S.I., F.R.S. Simla, 1915. Size 13 × 8. Pp. 33, 1 plate. *Part V., Sunspots and Temperature.* By Dr. G. T. Walker, C.S.I., F.R.S. Simla, 1915. Size, 13 × 8. Pp. 30, 1 plate.

In these two memoirs Dr. Walker deals respectively with the relation between sunspots and rainfall, and sunspots and temperature, at a large number of places over the earth's surface. The results of these two inquiries are on the whole not in sympathy with those who believe in the potent influence of variations in sunspot activity and corresponding variations in atmospheric conditions. "The general impression left by an examination of the chart may be one of disappointment at the comparative insignificance and inconsistency of the results; . . . . The co-efficient of rainfall with sunspots is not in general larger than would be produced by mere chance . . . . . It is only where the co-efficients over a region have some appreciable tendency towards uniformity that a real relationship may be concluded. The relationship seems real in the case of the Nile and India; but, perhaps the clearest case is South America, where below latitude 30° rainfall is deficient when sunspots are numerous." This latter remark regarding South American relations is of much interest, since it seems to

corroborate the belief which is officially expressed by several of the Weather Services in that continent. As regards temperature, it is shown that in the Polar regions of the Eurasian continent there is a tendency to higher values at times of sunspot maxima. This statement, to which attention has not hitherto been drawn, applies also to the western portion of Europe and of the Mediterranean, including Algeria.

Dr. Walker is extending the examination of the correlations so as to include pressure and other elements, when the problem as a whole will be considered in the light of the complete evidence. This extension of the subject will be looked forward to with much interest by those who agree that for such questions we require data dealing with the whole world. R.C.M.

Meteorology of Australia. Commonwealth Bureau of Meteorology. Results of Rainfall Observations made in Queensland. By H. A. HUNT, Commonwealth Meteorologist. Melbourne, 1914. Size, 12 × 9½. Pp. 285, and plates. Price, 10s. 6d.

THIS is the third and most recent of the series of rainfall investigations at present being published by the Commonwealth Bureau of Meteorology, and contains tabulations of all available annual totals and number of rain days for 1040 stations in Queensland. Many of the records extend over more than 30 years, so a good working basis is provided for the discussion of rainfall problems. Monthly and annual values to the end of 1912 are given for 137 representative stations, which, as the author remarks "will be found of especial interest in connection with inquiries and investigations in regard to local seasonal rainfall." The heaviest rains are in January and February and the bulk of the years' precipitation falls between December and April, when the heating of the centre of the continent is responsible for the formation of a low pressure area, or monsoonal depression accompanied by a permanent on shore wind. Over the greater portion of Queensland the winter is usually quite dry, the maximum rainfall is recorded at Harvey Creek, 167 inches, closely followed by Innisfail with 151 inches, both located in 17½° S., close to the coast. Inland the rainfall falls off very rapidly.

The work is well illustrated with 27 annual rainfall maps, monthly normal maps, an average rainfall map, an *interior* rainfall map of Papua, and many diagrams and maps showing distribution of frost, heights of floods, and frequency of wind, thunder and hail storms. A very interesting general chronological history of remarkable atmospheric occurrences during the past half century is also given, and an appendix contains monthly and yearly meteorological means and extremes at Brisbane from 1887 to 1912. R.C.M.

RAINFALL TABLE FOR DECEMBER, 1915.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH. Aver. 1875—1909. in.	1915. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	2·13	5·64
Tenterden	*Kent*	51 4	*0 41	190	2·77	6·94
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·91	8·42
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	3·23	9·26
Oxford (Magdalen College).	*Oxfordshire*	51 45	1 15	186	2·06	4·41
Wellingborough (Swanspool)	*Northampton*	52 18	0 41	155	2·13	4·30
Shoeburyness	*Essex*	51 31	*0 48	13	1·71	4·23
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	2·14	3·52
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	2·07	3·43
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	4·46	9·52
Rousdon [Lyme Regis]	,,	50 41	3 0	516	3·68	8·01
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·71	4·73
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·99	6·51
Boston	*Lincolnshire*	52 58	0 1	11	1·88	4·90
Worksop (Hodsock Priory).	*Nottinghamshire*	53 22	1 5	56	2·17	5·31
Mickleover Manor	*Derbyshire*	52 54	1 32	280	2·38	4·88
Macclesfield	*Cheshire*	53 15	2 7	501	3·35	4·98
Southport (Hesketh Park)	*Lancashire*	53 39	2 59	38	3·10	6·44
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	6·75	9·89
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	2·27	5·88
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	2·32	5·02
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	2·46	6·50
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	15·14	21·03
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	4·70	8·55
Haverfordwest	*Pembroke*	51 48	4 58	90	5·18	9·48
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	4·66	8·27
Llandudno	*Carnarvon*	53 20	3 50	72	2·84	6·54
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·84	8·77
Marchmont House	*Berwick*	55 44	2 24	498	2·83	6·75
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	5·48	7·17
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·95	4·87
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	8·57	5·35
Mull (Quinish)	,,	56 34	6 13	35	6·59	7·85
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·67	6·10
Braemar	*Aberdeen*	57 0	3 24	1114	3·13	6·68
Aberdeen (Cranford)	,,	57 8	2 7	120	3·43	7·00
Gordon Castle	*Moray*	57 37	3 5	107	2·72	5·15
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	5·62	4·55
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	9·86	9·00
Dunrobin Castle	*Sutherland*	57 59	3 56	14	3·09	5·35
Wick	*Caithness*	58 26	3 6	77	3·11	4·41
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	6·92	8·08
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	4·32	6·89
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	4·34	6·09
Ennistymon House	*Clare*	52 57	9 18	37	5·03	7·36
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·42	7·13
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·41	4·58
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·27	4·88
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·39	5·84
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	6·11	10·25
Cong (The Glebe)	,,	53 33	9 16	112	5·42	8·21
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	4·34	7·39
Seaforde	*Down*	54 19	5 50	180	3·77	7·29
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·87	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·91	5·79

RAINFALL TABLE FOR DECEMBER, 1915—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875–1909. in.	1915. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875–1909. in.	STATION.
+3·51	255	·72	9	22	25·11	32·18	+7·07	128	25·11	Camden Square
+4·17	251	·79	9	23	27·64	34·58	+6·94	125	27·64	Tenterden
+5·51	289	1·00	9	26	30·48	42·44	+11·96	139	30·48	Patching
+6·03	287	·94	23	24	31·87	43·41	+11·50	136	31·87	Cadland
+2·35	214	·69	9	23	24·58	29·38	+4·80	120	24·58	Oxford
+2·17	202	·56	4	25	25·20	24·77	— ·43	98	25·20	Swanspool
+2·52	247	·62	3	19	19·28	25·66	+6·38	133	19·28	Shoeburyness
+1·38	165	·50	9	21	25·40	24·56	— ·84	97	25·40	Westley
+1·36	166	·39	9	25	23·73	29·98	+6·25	126	23·73	Geldeston
+5·06	213	·96	5	27	38·27	46·36	+8·09	121	38·27	Polapit Tamar
+4·33	218	·95	14	28	33·54	39·72	+6·18	118	33·54	Rousdon
+2·02	175	·66	26	23	29·81	32·46	+2·65	109	29·81	Stroud
+3·52	218	·85	4	28	32·41	39·55	+7·14	122	32·41	Wolstaston
+3·02	261	·78	4	26	23·35	26·92	+3·57	115	23·35	Boston
+3·14	245	1·01	4	24	24·46	25·74	+1·28	105	24·46	Hodsock Priory
+2·50	205	·92	4	23	26·65	31·65	+5·00	119	26·65	Mickleover
+1·63	149	·60	27	19	34·73	34·08	— ·65	98	34·73	Macclesfield
+3·34	208	·93	5	27	32·70	32·05	— ·65	98	32·70	Southport
+3·14	147	1·75	5	24	61·49	52·81	—8·68	86	61·49	Arncliffe
+3·61	258	1·00	4	18	26·87	28·49	+1·62	106	26·87	Ribston Hall
+2·70	216	1·04	4	27	26·42	27·87	+1·45	105	26·42	Hull
+4·04	264	·91	4	26	27·94	26·37	—1·57	94	27·94	Newcastle
+5·89	139	2·00	12	23	129·48	103·52	—25·96	80	129·48	Seathwaite
+3·85	182	1·44	14	28	42·28	40·47	—1·81	96	42·28	Cardiff
+4·30	183	1·38	5	28	46·81	49·27	+2·46	105	46·81	Haverfordwest
+3·61	177	·89	20	29	45·46	45·27	— ·19	100	45·46	Gogerddan
+3·70	230	·72	4	25	30·36	33·56	+3·20	111	30·36	Llandudno
+3·93	181	1·53	5	24	43·47	45·65	+2·18	105	43·47	Cargen
+3·92	238	1·17	5	24	33·76	33·57	— ·19	99	33·76	Marchmont
+1·69	131	·80	31	25	49·77	44·12	—5·65	89	49·77	Girvan
+ ·92	123	·87	10	23	35·97	28·70	—7·27	80	35·97	Glasgow
—3·22	119	·71	31	24	68·67	55·34	—13·33	81	68·67	Inveraray
+1·26	119	1·73	10	22	56·57	45·20	—11·37	80	56·57	Quinish
+3·43	228	1·06	5	20	28·64	29·99	+1·35	105	28·64	Dundee
+3·55	213	·85	31	23	34·93	43·03	+8·10	123	34·93	Braemar
+3·57	204	1·27	5	24	32·73	36·65	+3·92	112	32·73	Aberdeen
+2·43	189	·82	10	28	30·34	37·40	+7·06	123	30·34	Gordon Castle
—1·07	81	·94	7	25	44·53	32·84	—11·69	74	44·53	Fort Augustus
— ·86	91	1·61	7	23	83·93	71·80	—12·13	86	83·93	Bendamph
+2·26	173	·83	6	18	31·90	32·82	+ ·92	103	31·90	Dunrobin Castle
+1·30	142	...	...	...	29·88	26·62	—3·26	89	29·88	Wick
+1·16	117	1·79	31	28	54·81	52·40	—2·41	96	54·81	Killarney
+2·57	160	·97	26	22	39·57	41·42	+1·85	105	39·57	Waterford
+1·75	140	·90	26	23	39·43	41·72	+2·29	106	39·43	Castle Lough
+2·33	146	·68	31	26	46·52	48·67	+2·15	105	46·52	Ennistymon
+3·71	208	1·08	31	24	34·99	40·57	+5·58	116	34·99	Courtown Ho.
+1·17	136	·56	26	24	35·92	35·46	— ·46	99	35·92	Abbey Leix
+2·61	215	·53	3	25	27·68	33·54	+5·86	121	27·68	Dublin
+2·45	172	·85	31	23	36·15	41·52	+5·37	115	36·15	Mullingar.
+4·14	168	1·96	31	30	52·87	54·83	+1·96	104	52·87	Enniscoe
+2·79	152	1·31	31	25	48·90	50·24	+1·34	103	48·90	Cong
+3·05	170	·68	31	30	42·71	46·50	+3·79	109	42·71	Markree
+3·52	193	1·18	26	28	38·91	40·26	+1·35	103	38·91	Seaforde
...	...	...	...	...	37·56	...	...	...	37·56	Dundarave
+1·88	148	·60	31	27	39·38	39·03	— ·35	99	39·38	Omagh

SUPPLEMENTARY RAINFALL, DECEMBER, 1915.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	7·65	XI.	Lligwy	6·32
,,	Ramsgate	5·19	,,	Douglas	8·11
,,	Hailsham	9·62	XII.	Stoneykirk, Ardwell House...	7·08
,,	Totland Bay, Aston House...	8·88	,,	Carsphairn Shiel	10·45
,,	Stockbridge, Ashley..	7·46	,,	Beattock, Kinnelhead	8·95
,,	Grayshott	8·39	,,	Langholm, Drove Road	8·83
III.	Harrow Weald, Hill House...	5·51	XIII.	Meggat Water, Cramilt Lodge	7·04
,,	Caversham, Rectory Road ...	5·64	,,	North Berwick Reservoir.....	4·20
,,	Pitsford, Sedgebrook...	3·75	,,	Edinburgh, Royal Observaty.	4·34
,,	Woburn, Milton Bryant.....	3·98	XIV.	Maybole, Knockdon Farm ...	6·29
,,	Chatteris, The Priory..... ...	3·24	XV.	Ballachulish House	9·30
IV.	Elsenham, Gaunts End	4·63	,,	Campbeltown, Witchburn ..	7·22
,,	Colchester, Hill Ho., Lexden	4·27	,,	Holy Loch, Ardnadam.....	9·23
,,	Ipswich, Rookwood, Copdock	5·09	,,	Islay, Eallabus	6·19
,,	Blakeney	3·67	,,	Tiree, Cornaigmore	6·55
,,	Swaffham	4·07	XVI.	Dollar Academy	6·63
V.	Bishops Cannings	5·76	,,	Balquhidder, Stronvar.....	7·44
,,	Wimborne, St. John's Hill ...	9·56	,,	Glenlyon, Meggernie Castle..	8·75
,,	Ashburton, Druid House.. ...	15·51	,,	Blair Atholl	5·57
,,	Cullompton	8·06	,,	Coupar Angus	6·06
,,	Lynmouth, Rock House	8·96	,,	Montrose, Sunnyside Asylum.	6·72
,,	Okehampton, Oaklands.. ...	10·48	XVII.	Alford, Lynturk Manse	8·57
,,	Hartland Abbey.....	7·84	,,	Fyvie Castle	8·47
,,	Probus, Lamellyn.....	7·99	,,	Keith Station	6·90
,,	North Cadbury Rectory.....	6·34	XVIII.	Rothiemurchus	3·05
VI.	Clifton, Pembroke Road.....	7·18	,,	Loch Quoich, Loan	12·90
,,	Ross, The Graig	5·29	,,	Drumnadrochit..... ..	5·32
,,	Shifnal, Hatton Grange.....	4·37	,,	Skye, Dunvegan	8·28
,,	Droitwich.....	4·62	,,	Lochmaddy, Bayhead	4·38
,,	Blockley, Upton Wold.....	5·18	,,	Glencarron Lodge	6·59
VII.	Market Overton.....	5·64	XIX.	Invershin	5·29
,,	Market Rasen	3·99	,,	Melvich	7·51
,,	Bawtry, Hesley Hall	5·50	,,	Loch Stack, Achfary	8·36
,,	Derby, Midland Railway.....	4·85	XX.	Dunmanway, The Rectory ..	10·30
,,	Buxton	8·96	,,	Glanmire, Lota Lodge.....	6·74
VIII.	Nantwich, Dorfold Hall	5·06	,,	Mitchelstown Castle	5·71
,,	Chatburn, Middlewood	6·77	,,	Darrynane Abbey.....	6·59
,,	Lancaster, Strathspey	6·95	,,	Clonmel, Bruce Villa	5·17
IX.	Langsett Moor, Up. Midhope	9·04	,,	Newmarket-on-Fergus, Fenloe	4·63
,,	Scarborough, Scalby	6·43	XXI.	Laragh, Glendalough	...
,,	Ingleby Greenhow	5·24	,,	Ballycumber, Moorock Lodge	4·37
,,	Mickleton	6·40	,,	Balbriggan, Ardgillan	4·29
X.	Bellingham, High Green Manor	5·73	XXII.	Ballynahinch Castle.....	8·80
,,	Ilderton, Lilburn Cottage ...	5·15	,,	Woodlawn	5·90
,,	Keswick, The Bank.....	10·40	,,	Westport, St. Helens	8·64
XI.	Llanfrechfa Grange	9·87	,,	Dugort, Slievemore Hotel ...	8·02
,,	Treherbert, Tyn-y-waun	19·74	,,	Mohill Rectory	6·74
,,	Carmarthen, The Friary	10·11	XXIII.	Enniskillen, Portora.....	6·08
,,	Fishguard, Goodwick Station.	8·13	,,	Dartrey [Cootehill]	5·74
,,	Crickhowell, Tal-y-maes.....	11·50	,,	Warrenpoint, Manor House ..	6·47
,,	New Radnor, Ednol	6·35	,,	Banbridge, Milltown	5·17
,,	Birmingham WW., Tyrmynydd	13·45	,,	Belfast, Cave Hill Road	4·54
,,	Lake Vyrnwy	...	,,	Ballymena Harryville	6·21
,,	Llangynhafal, Plâs Draw.....	5·48	,,	Londonderry, Creggan Res...	5·75
,,	Dolgelly, Bryntirion.....	13·96	,,	Dunfanaghy, Horn Head ...	7·79
,,	Bettws-y-Coed, Tyn-y-bryn...	9·95	,,	Killybegs	9·90

THAMES VALLEY RAINFALL. —— DECEMBER, 1915.

Symons's Meteorological Magazine.

Watershed of River Thames above Teddington, and River Lee above Feildes Weir. ——

Rainfall Stations reporting - - - - - -

Isohyetals ——

THE WEATHER OF DECEMBER.

SAVE for brief spells of anticyclonic weather about the 13th, 19th and 20th, the weather of December was dominated by a procession of Atlantic depressions, which brought prolonged rough weather and almost daily rain over a very wide area. The conditions were, in fact, very similar to those of December, 1914, the rainiest month of the preceding winter, and it is noteworthy that the distribution of rainfall also was of the same character, being most excessive in relation to the average in the east of Great Britain, and about half the country receiving more than twice its normal rainfall. Only limited areas in the least rainy districts of Ireland, Scotland and England had a smaller total rainfall than 5 inches during the month. More than 6 inches fell everywhere in the south-west of England and Wales, over the whole of the Pennine area, and very nearly the whole of Scotland, but in Ireland the eastern half generally had rather less. Large areas in the south of England extending as far east as Dover had more than 8 inches, and more than 10 inches fell over all the mountain districts in the west of Great Britain, as well as over a small part on the west coast of Ireland, but in the west Highlands these areas occupied only their normal position for December. More than 20 inches fell in the rainiest part of the English Lakes, South Wales and Dartmoor, and more than 30 inches at some Snowdon stations. The map of the distribution of rainfall in December in theThames Valley on the opposite page is a good example of the normal winter type of rainfall distribution in a very wet month. It will be observed that the heaviest rainfall, exceeding 7 inches, and in some places reaching 10 inches, fell just south of the Valley, and the least, rather less than 4 inches, outside the Valley in the north-east. In the Thames estuary nearly 5 inches fell.

The general rainfall of the great divisions of the British Isles was as follows: England and Wales, 198 per cent; Scotland, 135 per cent; and Ireland, 158 per cent. For the British Isles as a whole the rainfall was 169 per cent. of the average.

The temperature was abnormally high in England and Wales during the first fortnight. Temperatures above 50° were recorded at many stations, and on the 9th and 10th the maximum exceeded 55° over a large area in the south of England. In Scotland, however, colder conditions prevailed, and minima below 20° were common about the 4th, 5th and 9th. The amount of sunshine was small during this period, except in Ireland. With a change from south-westerly to northerly winds about the 12th, colder and more sunny weather was experienced over the country generally, especially in the south of Ireland, where several sharp frosts occurred. Colder weather also accompanied the anti-cyclone of the 19th, the lowest temperatures being observed in Scotland and Ireland, but from this period till the end of the month the weather over the United Kingdom generally was again abnormally mild, with little sunshine and much rain.

In London (Camden Square) the rainfall of December was 5·64 in., being 3·51 in., or 165 per cent. above the average of 50 years. This fall had been exceeded in December only twice in the previous 58 years, viz., in 1876 and 1914,when 6·25 in. and 6·34 in. fell respectively. The mean shade temperature was 43°·9, or 4°·2 above the average. This figure had been reached in six previous Decembers, the highest being 46·8 in. December, 1868. The duration of rainfall was 98·2 hours, or 19·3 hours less than in December, 1914. The total evaporation was ·00 in. the depth of water in the tank actually showing a net condensation of ·03 in. during the month.

The duration of bright sunshine at Camden Square was 19 hours, no fewer than 16 days being sunless, and only 7 having as much as 1 hour. The total duration recorded at other stations was as follows : Totland Bay, 43 hours; Copdock, 46 hours; Sidmouth, 39 hours; Weymouth, 30 hours; Ashbourne, 26 hours, Southport, 34 hours; Bolton, 12 hours; Hull, 27 hours; Haverfordwest, 39 hours; Swinton (Berwickshire), 19 hours; Paisley, 21 hours; Perth, 19 hours.

Climatological Table for the British Empire, July, 1915.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	86·2	4	48·0	+13	71·3	53·4	52·9	74	135·1	44·8	4·10	14	6·6
Malta	91·0	13	66·5	4	83·2	71·5	...	85	140·0	...	·00	0	2·5
Lagos	84·0	*8	71·0	‡10	82·0	73·8	72·3	83	154·0	70·0	15·51	21	9·2
Cape Town	65·1	20	35·3	15	58·2	45·8	47·0	84	...	...	6·68	18	5·8
Natal, Durban ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Johannesburg	67·7	27	27·4	23	55·7	40·4	35·3	75	...	27·1	2·76	10	4·6
Mauritius	77·6	7	54·8	23	75·0	62·4	60·7	78	...	48·2	2·75	19	4·9
Bloemfontein	66·7	12	21·0	2	55·9	31·1	34·4	86	..	...	1·44	6	5·8
Calcutta...	96·6	11	74·2	12	90·5	79·7	78·4	84	...	70·8	10·52	10	8·5
Bombay...	89·1	14	75·4	28	86·4	79·1	77·5	84	132·8	64·7	14·39	26	7·7
Madras	105·8	3	70·6	15	94·2	78·7	74·1	74	155·2	70·8	8·80	11	6·2
Colombo, Ceylon ...	87·4	5	72·1	30	84·6	75·5	74·0	85	153·8	68·9	12·63	28	7·7
Hongkong	93·4	28	74·8	17	88·1	79·3	76·7	81	...	...	15·41	18	6·6
Sydney	65·8	20	41·0	5	60·9	46·8	45·2	75	109·8	31·9	5·40	13	5·3
Melbourne	63·8	27	32·7	15	58·3	45·1	43·6	73	108·9	25·6	1·72	18	5·9
Adelaide	66·8	30	37·9	15	60·0	46·8	46·2	77	118·3	28·4	2·73	16	5·9
Perth	69·2	2	39·2	19	63·5	49·2	49·1	76	133·2	35·0	7·70	22	6·2
Coolgardie	68·6	2	35·0	21	59·7	43·9	42·6	69	127·4	30·4	2·07	12	6·4
Hobart, Tasmania ..	62·4	1	30·1	9	52·7	40·1	37·6	68	105·6	22·8	·62	22	6·1
Wellington ...	59·8	21	33·2	16	55·1	44·6	44·7	83	111·4	24·0	3·88	13	7·3
Auckland	62·5	25	36·5	31	58·3	47·1	48·3	85	113·0	34·0	7·32	20	6·5
Jamaica, Kingston ..	92·8	16	69·5	11	90·8	74·3	72·4	74	...	...	·42	3	...
Grenada	90·0	26	70·0	3	85·0	74·0	...	78	136·0	...	12·22	21	4·0
Toronto	86·5	16	50·9	6	77·5	59·3	60·8	80	143·8	48·3	4·50	13	5·4
Fredericton	84·3	28	44·0	7, 22	76·0	53·7	58·0	77	...	...	4·56	10	5·3
St. John, N.B. ...	80·0	13	49·5	5	68·5	53·3	54·6	79	...	...	4·45	11	6·0
Alberta, Edmonton ...	80·4	21	39·6	3	69·7	49·2	...	73	139·8	30·0	3·62	19	5·4
Victoria, B.C.	87·4	20	50·0	23	67·2	52·6	51·7	76	144·0	45·5	·84	9	4·5

* 18, 29. † 18. ‡ 11.

Johannesburg—Bright sunshine, 210·3 hours.

Mauritius—Mean temp. 0°·5, dew point 1°·0, and R ·11 in., above averages. Mean hourly velocity of wind 1·59 miles below average.

Bloemfontein—Coldest and wettest July on record, The snowstorm on the 19th was the first since 1880.

COLOMBO, CEYLON—Mean temp. 80°·0, or 0°·9 below, dew point 0°·2 below, and R 6·28 in. above, averages.

HONGKONG—Mean temp. 83°·2, mean hourly velocity of wind 10·4 miles. Bright sunshine 219·3 hours.

Melbourne—Mean temp. 51°·7, the highest for 60 years and 3°·2 above the average. R ·12 in. below average. Bright sunshine, 95·0 hours.

Adelaide—Mean temp. 1°·9 above, and R ·11 in. above, averages. Mean. temp., with one exception, highest on record.

Coolgardie—Temp. 0°·8 above, and R about one inch above, averages.

Hobart—Temp. 1°·1 above, and R 1·48 in. below, averages.

Wellington—Mean temp 2°·3 above, and R 1·96 in. below, averages. Bright sunshine 84·4 hours. Frost on eight days.

Auckland—Unusually wet, R 2·37 in. above, mean temp. slightly above, averages.

ALBERTA, EDMONTON—Cold and wet month. TSS on 5 days.