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THE RAINFALL OF 1905.

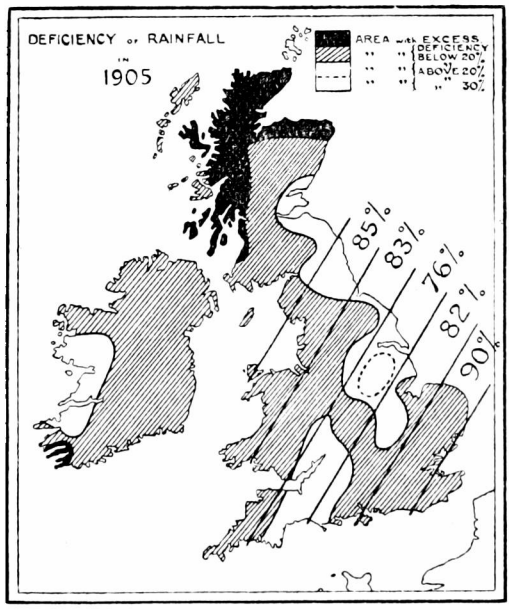
The Aggregate Table this month takes the form of a summary of the total rainfall for the year in relation to the average. The month of December proved to be dry in all parts of the country and remarkably so in most parts of England, where an absolute drought of 18 days prevailed in many places. The results shown in the following table were supplemented by data from a number of additional stations which were published in a special article in *The Times* of January 12th. The average of 84 well-distributed stations shows that in 1905 the general rainfall of England and Wales was only 83 per cent. of the average, showing a deficiency of 17 per cent., or 5·76 in.; the general rainfall of Ireland was 89 per cent. of the average, a deficiency of 11 per cent., or 4·65 in.; the general rainfall of Scotland was 96 per cent. of the average, the deficiency being unimportant, only 4 per cent., or 1·91 in.; while the general rainfall of the British Isles was 87 per cent., indicating a deficiency of 13 per cent., or 5·10 in. over the whole surface. The year was thus exceptionally dry, and maintains the sequence of one wet year followed by two dry years which has now prevailed for the country as a whole for 15 years. The time of reversal of the three-year period has evidently not yet arrived, though Mr. Jenkins's recent discussion of the matter leads one to expect the present order of things to change and give place to another before very long.

The geographical distribution of the variation from average rainfall is remarkable. The west and north of Scotland had slightly more than the average amount, the relatively wettest part of the British Isles being the district bordering the south shore of the Moray Firth, where the excess exceeded 10 per cent. The south-east of Scotland had a deficiency of more than 20 per cent., and so had almost the whole of north-eastern, central and south-western England. The south-east of England, including Cambridge, Norfolk, Suffolk, Hertford, London, most of Essex and Kent, Surrey and Sussex had a deficiency less than 10 per cent., the rainfall having been relatively greater than in other parts of England. The greatest deficiency was experienced in a diagonal belt of country, fifty miles wide, running south-westward from the East Riding of Yorkshire to South Devon,

Aggregate of Rainfall for January—December, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	22·97	91	Bolton	39·20	92	Braemar	35·43	98
Tenterden	26·74	94	Wetherby	22·74	84	Aberdeen	31·19	94
Hartley Wintney	23·38	86	Arncliffe	51·25	84	Cawdor	30·22	103
Hitchin	23·26	94	Hull	20·19	75	Invergarry	55·78	100
Winslow	21·19	79	Newcastle	21·49	77	Bendamph	86·53	100
Westley	21·86	86	Seathwaite	116·92	88	Dunrobin	31·80	101
Brundall	22·96	90	Cardiff, Ely	32·84	77	Killarney	46·37	80
Alderbury	25·78	88	Haverfordwest	39·23	82	Waterford	33·48	85
Winterbourne	31·20	80	Gogerddan	41·21	91	Broadford	30·45	91
Torquay	27·88	80	Llandudno	26·05	84	Carlow	28·80	84
Polapit Tamar	32·85	85	Cargen	34·69	80	Dublin	25·29	91
Bath	22·79	74	Lilliesleaf	26·63	81	Mullingar	31·98	88
Stroud, Upfield	25·94	87	Colmonell	41·44	92	Ballinasloe	28·47	77
Woolstaston	26·16	79	Glasgow	29·62	83	Clifden	63·20	79
Bromsgrove	20·04	82	Inveraray	68·53	109	Crossmolina	47·48	94
Boston	20·99	90	Islay, Eallabus	51·79	109	Seaforde	33·70	87
Hodsock Priory	16·91	68	Mull	56·32	98	Londonderry	36·53	89
Derby	17·43	67	Dundee	22·20	77	Omagh	36·09	95

the general deficiency in which was 24 per cent., or practically one quarter of the average fall. A considerable portion of this belt in the valley of the Trent had a deficiency exceeding 30 per cent., and the lowest percentages of the average rainfall amongst the records dealt with occurred here, at Derby 67 per cent. and at Hodsock Priory, near Worksop, 68 per cent. England and Wales may be divided into five parallel belts 50 miles wide, two north-east and two south-west of the dry belt, as shown on the accompanying map, which distinguishes regions with more than the average rainfall as black, and those with less than 80 per cent. of the average as white. It is then found that the general rainfall in each belt, taken in order from north-west, diminished to the central one and then increased, the percentages running 85, 83, **76**, 82, 90, as given on the side of the map, thus showing that for some reason



the deficiency of rainfall was greatest along the plain which runs from the Severn valley north of the Oolitic escarpment to the Vale of York, and that the deficiency was less and less marked towards the north-west and the south-east. It may be that the tracks of the storm centres crossing England during the year fell so that the zone of maximum rainfall was more frequently to the north and to the south of the central belt than upon it.

In Ireland the driest part relatively lay in the extreme west, the greater part of the counties of Galway, Clare, Limerick and Kerry having a deficiency of more than 20 per cent. The greater part of the north of Ireland and a patch in the south-west had less than 10 per cent. deficiency.

The foregoing discussion is, of course, preliminary and is liable to revision when the whole of the data are critically examined and worked up exhaustively for "British Rainfall, 1905."

COLDEST SPRING ON RECORD IN SOUTH AUSTRALIA.

By Sir Charles Todd, Government Astronomer.

The temperature conditions at the Adelaide Observatory (lat. 34° 56′ S., long. 138° 35′ E.) have been so remarkable and abnormal that the following brief analysis of the figures and comparison with the average for previous years may be of interest. In South Australia the year may be conveniently divided into two seasons—the summer months commencing with November and ending with March, and the autumn-winter-spring months (April to October), which may be termed the agricultural season, for then the crops are planted and come to maturity. The latter end of August, September and October constitute the spring portion of the year. In the following table are given the mean temperatures for the spring of this year :—

Mean Temperature Table.

1905.	Mean of Daily Maxima.	Average previous 47 years.	Mean of Daily Minima.	Average previous 47 years.	Mean Monthly Temp.	Average previous 47 years.	Highest Reading.	Lowest Reading.
	°	°	°	°	°	°	°	°
August.....	59·5	62·0	43·5	45·8	51·5 *a*	53·9	68·8	34·8
September	60·5	66·4	43·5	47·8	52·0 *b*	57·1	75·1	35·9
October ...	64·3	72·8	46·1	51·5	55·2 *c*	62·1	77·0	38·9

a. In previous years August mean temperature has only once been lower than this (viz., 49°·9 in 1872).
b. September mean is the record lowest. (Previous min. 53°·8 in 1874.)
c. October ,, ,, ,, (,, ,, 58°·4 ,, 1886.)

The departure from normal conditions shown by the above figures (especially during the day) is very marked, but the extraordinary

character of the season is perhaps more clearly seen in the following analysis of the daily maximum and minimum readings :—

Daily Maxima.—Number of Days the Maximum Reading of the Thermometer lay between—

	50°0 & 54°9	55°0 & 59°9	60°0 & 64°9	65°0 & 69°9	70°0 & 74°9	75°0 & 79°9	80°0 & 84°9	85°0 & 89°9	90°0 & 94°9	95°0 & 99°9	100°0 & 104°9	Highest.	On	Lowest.	On
August, 1905	4	15	9	3	...	...	...	...	...	...	...	68·8	4	50·1*a*	29
Aver. for August (47 years)	1·1	10·2	12·4	5·1	1·8	0·3	0·1	...	...	...	...	82·0	1862	49·5	1882
September, 1905.	2	14	10	3	...	1	...	...	...	...	...	75·1	12	53·7	7
Aver. for Sept. 47 years)	0·3	4·3	10·5	6·9	3 9	2·7	1·2	0·2	...	...	...	90·7	1882	51·0	1880
October, 1905..	...	5	17	5	..	4	...	...	...	...	...	77·0*b*	5	58·0	30
Aver. for October (47 years)	...	0·9	5·2	8·0	6·0	3·7	3·3	2·3	1·2	0·3	0·1	100·5	1859	55·4	1898

a. Coldest day on record for the latter half of August.
b. Lowest monthly maximum on record for October.

Daily Minima.—Number of Nights the Minimum Reading of the Thermometer lay between—

	30°0 & 34°9	35°0 & 39°9	40°0 & 44°9	45°0 & 49°9	50°0 & 54°9	55°0 & 59°9	60°0 & 64°9	65°0 & 69 9	70°0 & 74°9	75°0 & 79°9	Warmest Night.	On	Coldest Night.	On
August, 1905	1	8	9	11	2	...	...	...	...	...	51·9	25	34·8*a*	21
Aver. for August (47 years)	0·1	3·3	9·7	12·5	4·4	0·8	0·2	...	...	...	65·1	1871	32·3	1859
September, 1905.	...	8	12	8	2	...	...	...	...	...	52·9	12	35·9*b*	28
Aver. for Sept. (47 years)	...	1·4	7·4	11·4	6·9	2·1	0·6	0·2	...	...	66·3	1873	32·7	1858
October, 1905.....	...	1	11	15	3	1	...	...	...	...	58·7*c*	10	38·9	20
Aver. for October (47 years)	...	0·4	3·9	9·7	9·1	4·5	2·2	1·0	0·2	...	77·0	1861	36·1	1858

a. Only once a colder night than this in August.
b. Coldest night on record for latter half of September.
c. Only once before in 47 years has the warmest night in October been under 60° (viz., 59·4 in 1883).

Such a cold spring is unprecedented in the Observatory records ; the nearest approach to the present season being the year 1883 which previously held the record, being much lower than any other spring. This year (1905), however, completely eclipses 1883, as will

be seen from the following comparison of the mean temperature figures for the two years :—

	Mean Max.		Mean Min.		Mean Temp.		Highest Reading.		Lowest Reading.	
	1883	1905	1883	1905	1883	1905	1883	1905	1883	1905
Aug...	60°4	59°5	44°4	43°5	52°4	51°5	67°2	68°8	37°6	34°8
Sept...	62·6	60·5	46·3	43·5	54·4	52·0	76·3	75·1	40·9	35·9
Oct....	69·2	64·3	50·1	46·1	59·6	55·2	87·3	77·0	40·5	38·9

ON A SCHEME FOR THE CO-OPERATIVE STUDY OF BRITISH THUNDERSTORMS.

By L. C. W. Bonacina.

In studying any class of natural phenomena it is of paramount importance that not only the phenomena themselves may be investigated but also the physical circumstances that attend their manifestation; and it is further eminently desirable that all facts that can possibly have any bearing upon the phenomena in question be included in the study, in order that the science of these phenomena which it is proposed to establish may be made as wide as possible and to merge insensibly into the domain of kindred sciences.

Any proper and comprehensive scheme, therefore, for the study of thunderstorms must discuss the storms themselves or their purely meteorological aspect, their relation to time and locality; or their climatological aspect, the extent to which they are influenced by geographical and geological features, what influence they exert upon the living world wherein they have a physiological significance, and the all-important questions of their causes and connection with the general state of the atmosphere.

As three or four observers have already expressed themselves willing to furnish such notices as may be required respecting thunderstorms occurring in their own neighbourhoods, we venture to propose for the consideration of readers of this Magazine the following scheme for the co-operative study of thunderstorms.

We propose that the report of each thunderstorm observed be based upon certain lines of information, viz. :—

(1). Date, time, and locality of occurrence of storm; full statement as to geographical features of locality and its geological formation in the first report, and the apparent influence exerted by these upon the storm.

(2). Type of thunderstorm. (See Explanation).

(3). Intensity of thunderstorm.

(4). From climatological stations, readings of temperature and humidity before, during and after the storm; amount and character of precipitation; general state of the sky and appearance of clouds; force and direction of the wind.

(5). Show climatological stations, height of barometer on morning and evening of the day for which the storm is reported.

(6). Time of commencement and ending of thunder, rain, &c.

(7). Natural history notes; loss of life, damage to property, &c., affected by the storm.

Explanation:

(1). It is not merely the relation of thunderstorms to geographical *position* that we wish to ascertain, but also their relation to geographical *features*. We suggest, therefore, that the reporting stations as they increase in numbers shall be classified according to the natural conditions of the country, not to the political divisions like the shires. We do not want, for example, to compare the thunderstorms of the *county* of Cumberland with those of the *county* of Kent, or of the *county* of Devon with those of the *county* of Lincoln, because none of those counties represent physical wholes; but we do want to compare the storms of the Lake District with those of the Weald, of Dartmoor with those of the Fen country, and so on, because those areas are well-defined natural divisions. The number of stations required for each of these divisions would of course vary with its size. Ranges of hills, like the North Downs, which separate the Weald from the Lower Thames Valley, should be regarded as distinct divisions and accordingly supplied with observers.

In this way we should soon learn the influence which the physical features of the land exert upon the frequency, intensity and path of travel of thunderstorms. The investigations of the Thunderstorm Committee seem to show that the paths of storms are governed rather by the distribution of atmospheric pressure than by the configuration of the land. The subject is a most interesting one and deserving of careful study.

(2). By the *type* of thunderstorm we mean the type of weather during the prevalence of which the storm occurs, and of which it is a phase. There are many types of weather that in this country are liable to cause thunderstorms. A familiar type of thunderstorm is that which often occurs after a period of high temperature in summer. Another well-known type of storm is that associated with a stagnant and intensely gloomy state of the atmosphere and a temperature often below the normal; thunderstorms of this kind, which are probably the most violent that occur in Britain, are frequently developed in the space between two anticyclones. The Kentish hailstorm of September 10th, 1902, belonged to this type. Then there are the thunder showers that accompany cool, broken weather in summer, and those associated with rough cyclonic conditions in winter. As an example of a thunderstorm of a singularly eccentric nature, we

may mention the one which passed over the metropolitan district on January 23rd, 1895, and which was characterized by a heavy snowfall together with violent thunder and lightning.

There exists, of course, no line of demarcation between any of these different types of thunderstorms; they merge imperceptibly into one another, so that it is not possible to attempt any systematic classification of thunderstorms according to type. Nor, indeed, is it needful to do so. Let every observer under this heading give what information he cares as to the appearance of the storm he is reporting, and the *general type of weather* during the prevalence of which it occurs. Our own knowledge of the state of weather prevailing over the country as a whole would throw further light upon the type of individual thunderstorms.

(3). The intensity of thunderstorms should not, of course, be judged solely by their effects upon objects, as two storms of similar intensity would never wreak the same amount of damage even in the same locality. It will, however, be easily estimated as slight, moderate, or severe, by the observer, provided he has the ordinary experience of British thunderstorms.

For reporting purposes let us fix the minimum intensity of thunder and lightning—namely, distant thunder or sheet lightning without thunder, as constituting a "thundery" day. In referring to this question of the intensity of thunderstorm phenomena, we must not lose sight of the limit that is imposed upon us by the senses. If the nervous system were sufficiently sensitive, there would probably be few showery days when thunder and lightning would not be perceived by it.

(4). Here we require a knowledge of the atmospheric conditions accompanying the storms reported.

Temperature:—Reports received from observers in possession of climatological stations should contain temperature readings taken before, during and after the storm, whilst a copy of the thermograph's record would be invaluable, and indeed essential to any investigation into many complex physical problems connected with thunderstorms.

Humidity:—Readings of the wet bulb thermometer should be inserted. Theoretically, a low relative humidity combined with a high absolute humidity at the surface of the Earth should represent the conditions most favourable to thunderstorm development.

Precipitation:—The character, duration, and amount of precipitation that occurs in a thunderstorm should be noted. When hail characterizes a thunderstorm, we would urge that a note be made of the directions of motion of the upper and lower clouds of the storm, together with a note upon the localization of the hail in the district reporting it. (See Abercromby in "Weather," pp. 288—291). It should be borne in mind that hail exhibits a tendency to fall in parallel bands on either side of the central area of the storm where often rain alone falls.

Clouds, Wind, &c.:—Close observations upon the direction and force of the wind, of the forms, changes and movements of the clouds, together with notices of the occurrence of globular lightning, St. Elmo's Fire, and Aurora should form a feature of every thunderstorm report.

(5). Barometric readings, taken morning and evening, for the thundery days must be entered in the reports. Copies of the barometric traces, showing the oscillations so characteristic of thundery weather, would be of the greatest value as these oscillations appear to be the visible effect of a series of atmospheric waves, and to be in some way connected with lightning strokes (Thunderstorm Committee Report). When it will be desired to make a minute study of the distribution of atmospheric pressure during any thundery period, it will be necessary to obtain barometric readings for that period from as many meteorological stations as possible, in order that charts may be constructed showing differences of pressure for hundredths of an inch. The frequent thunderstorms of the month of June, 1888, were thus studied in relation to the accompanying distribution of pressure by Mr. William Marriott in his discussion of the observations of the Thunderstorm Committee, and submitted to this process of analysis they yielded some important knowledge, such as that thunderstorms are comparable to miniature cyclonic systems.

Thnnderstorms, as is well known, are the accompaniment of certain types of distribution of atmospheric pressure. It must not be forgotten that often in summer, when the distribution of pressure is favourable to the development of thunder and lightning, that this very distribution has itself been brought about in great measure by the effects of strong solar radiation over the land, which tends to keep atmospheric pressure relatively low over the land and to give rise to local convection currents resulting in rapid condensation of aqueous vapour and increased electrical density.

Let us turn to the Weather Chart issued for 8 a.m. on July 9th, 1905, a date, it will be remembered, when thunderstorms were very general over Great Britain. England and the north of France lay in the space between two high pressure systems, and, as had consequently been anticipated, thunderstorms developed early in the day in many localities. Now the precise distribution of atmospheric pressure that prevailed on that morning favourable to the formation of thunderstorms was, of course, the result of those unknown laws regulating the sequence of changes in the distribution of pressure from day to day and from minute to minute, modified by the disturbing effects normal to the season of strong solar radiation over England, and there can be but little doubt that the weakening of the anticyclone over England that had set in since 8 a.m. on the previous morning was to some extent, to what extent we cannot say, due to the high temperature that had prevailed over the country during the ensuing day, July 8th. The important point to be

remembered is that though the thunderstorms of July 9th would not have occurred had not the distribution of pressure been favourable, the fact that this was favourable must *in this case* be largely attributed to effects of previous hot weather.

To the discussion of such highly interesting questions we hope to devote a future article.

(6). We require to know the time of commencement and ending of thunder, rain and hail, in order that the paths and rate of travel of storms may be ascertained in accordance with the method employed in the discussion of the observations made under the direction of the Thunderstorm Committee.

(7). Observers interested in any branch of natural history would do useful work by supplying short notes concerning any phenomena that they can clearly associate with thundery conditions of the atmosphere. Information as to loss of human life, damage to buildings, cattle, &c., and the circumstances attending the catastrophes might also be added. Of the great forest trees the oak appears to be the most susceptible of lightning stroke, but in most parts of England the oak is the predominant tree, so that on that account alone more instances of injury to this than to less abundant species like the elm, beech and ash, are on record.

The main object of this scheme of study will be fourfold: to determine (1) the geographical and seasonal distribution of thunderstorms over the British Islands; (2) the close relation of thunderstorms to the distribution of atmospheric pressure; (3) the close relation of thunderstorms to atmospheric conditions; (4) the exact causes of thunderstorms.

By studying the geographical and seasonal distributions of thunderstorms together, curious tendencies towards thunderstorm development in certain localities at certain periods of the year, such as that observed by Dr. Mill towards the occurrence of storms in the south-east of England during the last week of July, will be discovered.

Paragraphs 6 and 7, therefore, in accordance with the main object of the scheme as stated above are of lesser importance, but references to them in the reports should never be omitted. To all who volunteer their assistance as observers type-written forms, giving details as to the manner in which it is desired that the reports be drawn up, will be sent, in order that they may be spared unnecessary trouble and expenditure, and we unnecessary labour in interpreting the reports.

We trust that the method of study here laid down may meet with such criticism as may enable defects in it to be remedied and omissions in it to be supplied. During the next few months thunderstorm work will be light, and there will be ample time for fresh suggestions to be received before storms increase again in frequency in the spring.

Let us conclude with the hope that the poetry of thunderstorm phenomena, whether expressed in verse, prose or art, may not be altogether neglected by those who would advance the science of them.

Despite all that is sometimes said to the effect that science is opposed to poetry, we maintain that it is largely the poetic expression of any object or phenomenon, of any land or sea-scape, of any quiet rural scene, that inspires a scientific interest in it and prevents such interest from flagging.

[We gladly publish the above article, and commend it to the attention of observers who are specially interested in thunderstorms; for we consider that the best way to revise and improve such a scheme is to give it a trial that will reveal its weak points and suggest modifications. Observers desirous of taking part should communicate with Mr. Bonacina, at 2, Greencroft Gardens, London, N.W.—ED. *S.M.M.*]

Correspondence.

THE HIGH BAROMETER IN DECEMBER.

To the Editor of Symons's Meteorological Magazine.

YOU will, no doubt, be receiving notices of the high barometric readings of the early part of this week, which I think were quite abnormal. I was at Cardiff, on business, and had my pocket aneroid with me. I noticed its rise on Monday the 11th, and wondered if it had "gone wrong." On Tuesday morning, 12th, at 8 a.m., the needle had gone beyond scale, and was equivalent to *31·12*, as near as I could judge without the scale under it. This was at 40 ft. above sea level.

On my return to London on Wednesday, and on each day since, I have compared the aneroid with my Negretti and Zambra mercurial, and find a constant index error of + ·12, which would make the Cardiff reading 31·00, subject to correction for 40 ft. above sea level. From the *Times* chart of Wednesday it would seem that the centre of the anti-cyclone was over Cardiff. I shall be interested to see if my readings are confirmed, and whether you will tell us next month that the 12th of December, 1905, is comparable with January 18th, 1882. (See *Symons's Met. Mag.*, 1882, p. 8).

JAMES G. WOOD.

7, New Square, Lincoln's Inn, W.C., December 16th, 1905.

FOR the second time this year, and the fifth since my record commenced in 1878, the barometer has exceeded 30·900; on December 12th, at 10.30 a.m., it attained the height of 30·937, corrected and reduced.

Two points may be noticed—(1.) The rise was unsteady. From 1.30 a.m. to 3 a.m., a rise of 0·070; a very slow rise for the next four hours; steady for two hours from 7 a.m. to 9 a.m., and then a rapid rise from 9 a.m. till 10.30 a.m., also of 0·070. (2.) Some time during the early morning hours of the 12th, while the barometer was above 30·800, there was a slight *shower of rain* (·02 in.).

CHARLES L. BROOK.

Harewood Lodge, Meltham, December 18th, 1905.

[At Camden Square the highest pressure occurred at 10.15 a.m., when the barometer read 30·873 inches, practically identical with that of January 15th, 1902, which was 30·874; but exceeded by January 28th, 1905, with 30·955, by January 9th and 30th, 1896, with 30·934 and 30·927; and by the still unsurpassed reading of January 18th, 1882, which was 30·975 inches. The isobar of 30·90 in. for 6 p.m. on 12th includes the west of Wales and the east of Ireland; but we have not seen any instance of 31·00 inches being observed with verified barometers.—ED. *S.M.M.*]

GREEN FLASH AT SUNSET.

I WOULD call attention to a phenomenon of atmospheric refraction frequently observed, but of which very little has been published. I refer to the green flash seen in clear weather as the last ray of the setting sun disappears. I observed this one evening in the North Atlantic, last month; I also saw it in the North Atlantic in October, 1898; on that last occasion I watched Venus setting a little later, but though the planet turned red occasionally it did not flash green at the last moment; I have, however, seen a planet flash green at setting.

The phenomenon is noticed in *Knowledge*, April, 1889, p. 126, where the colour is given as blue; also in *Nature*, March and April, 1890, pp. 495, 538, and in the Royal Astronomical Society's Notices, May, 1901. In these notices the writers appear to hold different views as to the cause. In "Elementary Meteorology," by Prof. W. M. Davis, p. 50, it is stated that after sunset every solar beam will be broken up into a short vertical spectrum; is this the explanation? if so why should the last flash be green? (according to some accounts of a remarkably vivid green). I would like to see that matter worked out.

J. P. MACLEAR.

Chiddingfold, December 19th, 1905.

[The beautiful phenomenon described by Admiral Maclear is very familiar to those who are on the watch when the sun sets, either on a sea horizon, or a straight strip of low land. We hope to publish an article upon it in an early number.—ED. *S.M.M.*]

CURIOUS EFFECT OF LIGHTNING.

A SIMILAR case to that reported by Mr. Haes was observed by me at Cranleigh in 1889. (*Quarterly Journal R.Met.Soc.*, Vol. 16, p. 229.) A tall tree stood over the gable end of a stable, the gable was struck, but there was no mark on the tree. I believe myself that the upper branches of the tree were highly charged, and when discharged suddenly the lightning preferred the warm moist air from the chimney to the trunk of the tree.

Warm air was probably coming up the chimney in the case related by Mr. Haes, although no fire was alight.

J. P. MACLEAR.

Beaconscroft, Chiddingfold, 20th December, 1905.

THE RAINFALL OF ENGLAND AND THE SOUTH-EAST TRADES.

IF an unknown writer were to assert that there was any connection between the South-East Trade Winds in the South Atlantic and the rainfall of the south of England, we should be inclined to examine his arguments with the same sort of interest as would attach to a homily on Tenterden Steeple and the Goodwin Sands. But when the Director of the Meteorological Office seriously propounds the coincidence in the pages of *Nature*, we feel that the matter is much more than a scientific curiosity. Dr. W. N. Shaw, writing on "The Pulse of the Atmospheric Circulation," in *Nature* for December 21st, 1905, shows that the average curve of the mean monthly velocity of the wind at St. Helena for 1892—1903 is almost exactly similar to the curve of monthly incidence of rainfall for "England South" for 1866—1900. The resemblance in the two curves is certainly exceptional, and in one or two instances of individual years there are also indications of the same relationship. Dr. Shaw feels that the accordance cannot be altogether accidental. He says, "The fact that a seasonal variation of rainfall does show itself in the average of a few years has a meaning, and that its phases are closely similar to those of the arterial pulsations of the general atmospheric circulation accords too much with what may be called common sense to be altogether devoid of significance." The importance of such a relationship, if it can be established and extended, on practical problems of weather prediction can hardly be exaggerated.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1904.

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. Mean.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Rainfall. Depth.	Rainfall. Days.	Average. Cloud.
	°		°		°	°	°	°	%	°	°			0—10
London	91·0	August 4	24·1	November 26	58·1	43·2	50·6	45·0	85	135·9	16·5	2 65	160	6·2
Cape Town	100·5	January 23	36·9	July 21	69·4	53·9	61·6	52·9	73	...	...	31·82	112	4·7
Durban	101·1	September 3	48·8	June 28	79·4	61·5	70·4	...	...	159·2	...	34·72	141	4·1
Mauritius	89·9	February 22	50·9	Sept. 21	80·4	66·0	73·2	64·1	75	155·2	42·0	43·12	210	6·1
Calcutta	101·5	April 23	47·0	February 2	87·1	70·5	78·8	68·9	74	163·2	40·4	63·20	82	4·2
Bombay	94·7	March 30	62·3	January 19	86·7	75·5	81·1	71·7	75	141·2	56·5	33·42	90	3·7
Madras	103·5	June 3	61·2	February 1	91·4	74·3	82·9	69·8	71	161·2	56·4	18·15	78	4·3
Kodaikanal	77·3	April 6	39·9	January 7	64·3	50·3	57·3	47·8	72	146·2	23·4	46·62	148	4·9
Colombo	92·7	February 25	65·0	Feb. 3, 4	86·1	75·2	80·7	71·8	79	157·7	59·2	76·62	162	5·8
Hong-Kong	91·1	June 26	44·8	December 24	76·5	67·9	72·2	62·7	77	149·6	..	80·44	137	6·5
Melbourne	102·0	December 24	31·5	July 23	68·8	46·8	57·8	47·9	73	160·2	26·6	29·72	128	5·9
Adelaide	114·0	December 31	36·9	May 24, July 29	72·2	52·9	62·5	47·8	61	161·0	29·7	20·29	117	4·6
Coolgardie	108·6	December 27	32·0	July 14	76·3	52·0	64·1	46·1	54	180·5	23·5	11·77	72	3·8
Sydney	107·5	December 31	39·5	June 30	69·7	56·1	62·9	52·3	73	138·1	29·1	45·95	216	4·9
Wellington	82·3	January 21	32·0	July 3	60·9	48·0	54·5	44·5	67	140·0	29·0	60·41	170	6·4
Auckland	79·5	February 18	37·0	July23, Aug.5	63·4	52·5	58·0	50·4	76	148·0	29·0	45·70	175	5·4
Jamaica	89·9	July 8, Aug. 5, Sept. 4	63·8	January 7	85·5	71·3	78·4	71·5	78	...	...	64·20	101	...
Trinidad	91·0	May 13	61·0	Feb. 24, 25, 26	86·1	68·4	77·3	72·0	82	167·0	58·0	56·43	188	...
Grenada	91·4	October 31	68·4	Feb. 22, Jun. 7	82·9	73·3	78·1	70·2	75	156·2	...	69·75	254	3·6
Toronto	93·0	July 18	— 15·1	January 4	51·2	33·9	42·6	37·0	79	122·7	—18·2	35·71	151	6·0
Fredericton	86·1	July 20	— 35·0	February 6	49·9	27·4	38·7	27·1	58	...	...	41·46	116	5·5
Winnipeg	89·0	June 18	— 42·0	January 24	...	...	...	...	...	...	...	22·86	113	5·3
Victoria, B.C.	82·3	July 21	24·5	February 8	56·0	44·7	50·4	...	...	...	...	26·59	152	6·2
Dawson	80·0	August 9	— 57·8	January 14	30·8	13·0	21·9	...	...	...	...	12·04	74	4·7

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, December 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. G. C. Simpson gave an interesting account of his "Attempt to fly Kites for meteorological purposes from the mission ship attached to a deep-sea fishing fleet in the North Sea." These observations, which were made in July and August last, were carried out on behalf of the joint Kite Committee of the Royal Meteorological Society and of the British Association. By the kindness of the Royal National Mission to Deep-Sea Fishermen, the kites were flown from the deck of the mission-ship *Queen Alexandra*, attached to the Red Cross Fleet. Owing to the vessel being almost continuously employed in trawling, the opportunities for flying kites were very limited; nevertheless, Mr. Simpson was able to secure eight ascents without damage to kites or meteorographs during the time he was on board. The greatest height reached by the kites was 5800 feet.

Mr. C. J. P. Cave described his method of flying kites in Barbados in April and May last year, and Mr. W. H. Dines, who had examined the records, said that the humidity traces show generally a value of about 60 per cent. at the surface, rising to 80—90 per cent. at heights of 1000 to 2000 feet, and then falling off again in some cases to 50 per cent. or less as the height increases. These values are lower than might have been expected over a tropical ocean. The increase is of the ordinary kind, but the maximum value occurs at a far lower elevation than is the case in Europe. It is probable that the relative humidity forms an extremely accurate index to the vertical circulation, a low humidity indicating a descending current of air, and so it may be inferred that there is some settling down of the atmosphere over the region of the smaller West Indian Islands in April and May.

Mr. W. H. Dines, F.R.S., read a brief paper on "Temperature changes during the partial solar eclipse of August 30th, 1905, on the surface and at 3000 feet at Oxshott." The under surface of the cloud layer, which in the neighbourhood of London completely obscured the sky, was 2000 feet high. It seems probable that the kite was above the clouds, and that the cloud layer was only a shallow one, for the occupants of a balloon which ascended from London at 12.30 had a clear view of the eclipse; and also when the kite was drawn in at 4.28, and had just passed through the same clouds, it was not at all wet, as it certainly would have been had the descent through the clouds occupied any appreciable time. A trifling rise of temperature occurred as the shadow passed off, but Mr. Dines hardly thinks this was caused by the eclipse, especially as the same temperature was found at 3500 feet elevation at 4.28 as at 1.25 p.m. A meteorograph, which was suspended in a tree from 11.40 a.m. to 4.40 p.m., showed little or no change.

An interesting discussion followed the reading of these papers, in which the President, Dr. W. N. Shaw, Mr. E. S. Bruce, Mr. G. C. Simpson and Mr. W. H. Dines took part.

In the absence of the authors, the following papers were briefly presented by the Secretary :—

"Comparison between Glaisher's Factors and Ferrel's Psychrometric Formula," by J. R. Sutton, of Kimberley ; and "A Rapid Method of Finding the Elastic Force of Aqueous Vapour and the Relative Humidity from Dry-bulb and Wet-bulb Thermometer Readings," by Dr. J. Ball, of Cairo.

Dr. W. N. Shaw called attention to the great importance of hygrometric observations in this country, and deplored the neglect which has hitherto prevailed.

The following were elected Fellows of the Society :—Mr. W. S. Clark, Rev. D. Kennedy, D.D., Mr. J. Lyle, M.A., Mr. W. J. Marriott, Mrs. E. V. Pereira, Mr. J. M. Phillpott, Mr. C. Salter, Mr. A. C. Saxby, Mr. H. T. Scoble, Mr. R. Shastri, and Rev. H. Vaughan.

THE INVESTIGATION OF THE UPPER AIR.

THE Meteorological Office has issued the following communication to the press, and we publish it with a feeling of gratification that this country is at last taking its proper share in one of the most promising fields of Meteorological research.

In response to representations which have reached them from various quarters, the Meteorological Committee have assigned from the Parliamentary grant under their control a sum for promoting the investigation of the upper air by kites and other means.

The immediate objects in view are :—

1. To establish an experimental station where kite ascents and other experimental investigations can be carried out, especially on the days selected for international co-operation.

2. To develop and extend the instrumental equipment, so that facilities may be afforded for the co-operation of other observers upon sea or land.

3. To provide for the publication of the observations in combination with those of other countries by a contribution to the cost of the international publication undertaken by the president of the International Commission for Scientific Aerostation, Professor H. Hergesell, of Strassburg.

Mr. W. H. Dines, F.R.S., who is well known for the work he has done in connexion with a joint committee of the Royal Meteorological Society and the British Association, has undertaken the direction of the operations for the Meteorological Office. His experiments for the office are carried on at his house at Oxshott.

An endeavour will be made, with fair prospect of success, to enlist the co-operation of marine observers in correspondence with the office. Captain A. Simpson, of the steamship *Moravian*, an observer of long experience, has already expressed his willingness to make a trial of this method of extending

our knowledge of marine meteorology as soon as the necessary gear and instruments can be supplied.

It is hoped that through the asssistance of others who are interested in such investigations, and have at their disposal the means of carrying them out, an effective scheme for the investigation of the upper air may be set on foot. Lieutenant-Colonel J. E. Capper, C.B., R.E., of the Aldershot balloon companies, has already facilities for such purposes, and will take part; Mr. G. C. Simpson, Lecturer on Meteorology in the University of Manchester, is making arrangements for occasional observations on the Derbyshire hills; Mr. C. J. P. Cave, who has already made some interesting kite ascents in Barbados, has provided himself with the necessary equipment for experiments at Ditcham Park; and Mr. S. H. R. Salmon has arranged a station on the Downs, near Brighton, and carries out ascents on the International days.

There is, accordingly, a prospect of an effective investigation being commenced.

METEOROLOGICAL NEWS AND NOTES.

Miss Jessie Hill Buchan, for many years the right hand of her uncle, Dr. Alexander Buchan, in the office of the Scottish Meteorological Society, died suddenly on December 7th, to the profound regret of all who knew her, and greatly to the loss of meteorology in this country. Miss Buchan began to work at the Scottish Meteorological Society in 1868, and was Dr. Buchan's sole assistant until 1886. She had charge of the finance of the Society as Treasurer's clerk, and received all the subscriptions for the Ben Nevis Observatory. A large part of the regular work of the office, including the checking of the returns from the Society's stations, fell to her share, and she also did an immense amount of tabulating and computing for the many large and important papers published by Dr. Buchan, especially with reference to his Report on Atmospheric Circulation in the *Challenger* Reports. She was an unfailing helper and friend to all who had occasion to visit the Society's rooms, and her cheerful presence will be sorely missed.

The Climatological Summary for the British Empire in 1904 is published on another page, and this year we have endeavoured to disarm the criticism which has annually fastened upon this harmless and even official set of figures by refraining from stating in words that Dawson is cooler than Madras, or Coolgardie less humid than Colombo. The Table is there to speak for itself and it presents some features of real interest.

The Royal Meteorological Society has arranged for lectures on a meteorological subject by Mr. W. Marriott, in connection with the work of the local Scientific Societies Committee, on the following dates, at the places mentioned:— January 16th, at Sidcup, to the Literary and Scientific Society; January 23rd, at London, in Exeter Hall, to the Young Men's Christian Association; January 24th, at

Epsom, to the Epsom and District Literary and Scientific Society; February 2nd, at Harpenden, to the Social Union; February 8th, at Reading, to the Natural History Society; February 9th, at Bishop Stortford; February 10th, at Woolwich, to the Royal Arsenal Co-operative Institute; February 24th, at Colchester, one of the Essex Education Committees' Market day lectures; February 28th, at Nantwich; March 2nd, at Derby, to the Municipal Training College; and March 14th, at Doncaster, to the Scientific Society. We hope that all meteorological observers will make an effort to attend the lecture in their neighbourhood.

DR. H. R. MILL HAS ARRANGED TO LECTURE for the Gilchrist Educational Trust, on the subject of "Rain," at Dolgelly, on Wednesday, 14th February; at Portmadoc on Thursday, 15th February; at Holyhead on Friday 16th February; at Worcester on Monday, 12th March; and at Bridgnorth on Tuesday, 13th March. He has also arranged to give a lecture on a similar subject to the Royal Dublin Society, on the afternoon of Wednesday, March 7th.

SOLAR AND CLIMATIC VARIATIONS are discussed by Dr. C. Easton, of Rotterdam, in the August, 1905, number of *Petermanns Mitteilungen*. He shows a remarkable correspondence between the curve of solar activity and the curve of cold winters, and points out the probability of periodic variations of different duration existing, especially the familiar eleven-year sunspot period, and a period including eleven sunspot cycles, or 178 years.

"IRELAND IS ENGLAND'S UMBRELLA," lamented a resident in Donegal, complaining of interminable rains and floods during December. "I wish they would make holes in it," is the despairing comment of the rainfall observer in the drought-distressed Eastern Counties, who forwards the note to us.

REVIEWS.

Proceedings of the Third Convention of Weather Bureau Officials, held at Peoria, Ill., September 20, 21, 22, 1904. Washington: 1904. Size, 9½ × 6. Pp. 268.

THE practice of holding a three-yearly Convention of the Weather Bureau officials, who are scattered all over the United States in the local weather offices, affords an opportunity for the discussion of meteorological questions by a body of specialists similarly trained but accustomed to work with very different types of climate. This compact volume contains a number of important papers and discussions, but the most remarkable thing in it is the incidental recommendation by Professor Willis Moore in his "Letter of Transmittal," that 5000 copies should be printed. This gives some idea of the extent to which meteorology, and that not of a popular or elementary character, is expected to be appreciated on the other side of the Atlantic.

Seasons in the British Isles from 1878. By W. N. SHAW. Reprinted from the Journal of the Royal Statistical Society. London: 1905. Size $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 98.

THIS paper is a summary of the *Weekly Weather Report* of the Meteorological Office since the commencement of that publication, with certain deductions and applications. Dr. Shaw gives a clear statement of the object with which the *Weekly Weather Report* was founded; the treatment of weather on the basis of the week as a unit of time and the district as a unit of area mainly in the interest of agriculture. He then gives a table running to 25 pages, showing each county in the British Isles divided according as its mean annual rainfall is above or below 35 inches, with the agricultural characteristics of each division and the meteorological averages for the corresponding stations. He then deals with the succession of the seasons and gives a number of suggestive instances of the application of the data collected to practical ends. The whole paper is a fine instance of the statistical treatment of observations and the scientific attitude with regard to their ultimate utility.

The Bahama Islands. Edited by GEORGE BURBANK SHATTUCK, PH.D. New York and London: Macmillan. 1905. Size $10\frac{1}{2} \times 7\frac{1}{2}$. Pp. xxxii.+630.

THIS beautiful volume is published by the Baltimore Geographical Society and records the researches made and conclusions drawn by an expedition of scientific specialists who visited the islands in 1903. As is well known, the meteorology of the West Indies receives much attention from the Weather Bureau in Washington, and it will not surprise our readers so much as it would astonish the general public to find an important British possession on the verge of the tropics waiting for an adequate scientific description until our American cousins found leisure to take it up. Every aspect of the physical geography of the Bahamas is dealt with in a comprehensive way, earlier records being consulted to support the observations of the expedition, which extended over only five weeks in the islands.

Our concern here can only be the Magnetic and Meteorological chapters, of which there are three, written by the competent hand of Dr. Oliver L. Fassig, who was in charge of that department of the expedition. They deal with Magnetism, Climatology, and Kite Observations. The following summary of the absolute extremes of air temperature at Nassau is interesting in showing how the year of absolute minimum in six months (1869) was followed by the year of absolute maximum in four months (1870).

Extremes at Nassau, New Providence, from 1853 to 1902.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Min.....	49°	53°	49°	54°	61°	63°	66°	66°	64°	63°	58°	48°*
Year.....	1866	1865	1869	1869	1869	1869	1885	1869	1869	1857	1865	1868
Date.....	10	2	2	16	23	12	23	2	7	28	...	25
Max.	96	97	91	96	100	102	106	99	**109**	96	99	97
Year..... ...	1871	1871	1856	1872	1856	1870	1870	1871	1870	1872	1877	1870
Date.....	28	16	14	10	10	21	14	2	27	2	8	22

Perhaps the most interesting section is that on the hurricanes for which the West Indies are famous. Two discussions of the frequency of hurricanes in the West Indies in different months are given. These refer to the periods 1493—1855 and 1878—1900. In order to show the monthly frequency together, we have prepared the following table, covering 386 years, though leaving 24 years out of account, from 1856 to 1877.

Frequency of Hurricanes.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
No.	8	7	11	6*	6*	13	45	121	105	101	20	10	453
Per cent.	2	1·5	2·5	1·5	1·5	3	10	27	23	22	4	2	100

It is seen that 72 per cent. of the hurricanes occur in the three months August to October. Charts are given showing the tracks of all important hurricanes from 1878 to date.

Five kite ascents were made, the highest reaching 3858 feet, and the mean rate of decrease of temperature observed was 6°·1 per 1000 feet.

Report on the Climate and Weather of Baltimore and vicinity. By Oliver L. Fassig. Baltimore: The Johns Hopkins Press, 1904, 1905. Size $10\frac{1}{2} \times 7\frac{1}{2}$. Pp. (282). Plates.

This deals with the climate of Baltimore, the final instalment being reserved for the weather. The discussion is unusually full and minute, the diurnal variations of the various climatic elements being treated as well as the monthly and annual. A special feature is a series of diagrams combining in one figure the normal diurnal and monthly variations for a whole year. The discussion is so thorough and so full of interest that we greatly regret our lack of space in which to give an epitome of the mode of treatment at least. The memoir may well serve as a pattern for the complete study of the climatological record of a long-established station.

Les gradients verticaux de la Température dans les minima et les maxima barométriques. [Vertical gradients of temperature in barometric maxima and minima]. By S. Grenander. Upsala: (London, Wm. Wesley & Son), 1905. Size $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 16. Plates.

An extract from the mathematico-physical department of the Swedish Academy of Sciences. The author has studied the temperature records of a number of recent kite and balloon experiments and finds confirmation of the law enunciated by M. Teisserenc de Bort to the effect that the fall of temperature with height above a barometric depression is more rapid than above an anticyclone up to the elevation of about 13,000 to 16,000 feet, above which the relation is inverted.

RAINFALL AND TEMPERATURE, DECEMBER, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Greatest in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. Shade	No. of Nights below 32°. Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	·74	— 1·38	·17	7	7	57·1	7	29·2	12	6	12
II.	Tenterden ...	·73	— 2·01	·21	5	15	53·5	7	24·5	12	4	12
,,	Hartley Wintney ...	·71	— 1·84	·18	7	11	55·0	6, 7	24·0	12	7	10
III.	Hitchin ...	·78	— 1·27	·25	7	9	55·0	7	28·0	10*a*	7	...
,,	Winslow (Addington) ...	·90	— 1·37	·37	7	13	55·0	7	26·0	11	11	18
IV.	Bury St. Edmunds (Westley)	·73	— 1·38	·23	7	9	56·0	7	27·5	12	...	...
,,	Brundall ...	1·15	— ·98	·34	29	16	55·4	7	28·4	11	9	14
V.	Alderbury ...	·78	— 2·04	·29	5	8	56·0	7	26·0	10, 11	11	...
,,	Winterbourne Steepleton ...	1·25	— 2·88	·29	5	15	53·5	7	24·0	12	9	13
,,	Torquay (Cary Green) ...	1·01	— 2·45	·24	27	9	54·5	1	33·8	12	0	12
,,	Polapit Tamar [Launceston]	1·54	— 2·85	·29	7	15	53·6	7	21·0	4	8	9
,,	Bath ...	·93	— 1·83	·33	7	11	54·6	7	27·0	11	9	...
VI.	Stroud (Upfield) ...	·70	— 1·78	·34	7	10	54·0	7, 8	29·0	11	5	..
,,	Church Stretton (Woolstaston)	·76	— 2·16	·26	29	11	51·0	6, 7	25·0	31	19	...
,,	Bromsgrove (Stoke Reformatory)	·65	— 1·30	·21	7	6	52·0	7	23·0	25	18	...
VII.	Boston ...	·43	— 1·36	·22	28	5	52·0	7	29·0	10	9	...
,,	Worksop (Hodsock Priory).	·43	— 1·59	·21	28	10	56·5	7	27·2	13	11	23
,,	Derby (Midland Railway)...	·63	— 1·65	·27	28	15	54·0	7	28·0	10, 31	11	...
VIII.	Bolton (The Park) ...	·78	— 3·41	·13	19	14	50·5	6	30·8	31	2	16
IX.	Wetherby (Ribston Hall) ...	·40	— 1·79	·13	28	10	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	4·36	— 2·05	1·06	20	17	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	·41	— 1·95	·19	28	9	53·0	7	30·0	31	5	16
X.	Newcastle (Town Moor) ...	·46	— 2·18	·12	25	12	...	...	...	...	...	..
,,	Borrowdale (Seathwaite) ...	11·01	— 3·69	2·20	20	15	52·1	6	29·1	30	2	...
XI.	Cardiff (Ely) ...	2·19	— 2·24	·59	7	17	...	...	...	...	...	...
,,	Haverfordwest (High St.)...	1·74	— 3·48	·38	5	13	53·3	7	29·1	10	2	12
,,	Aberystwyth (Gogerddan)...	1·62	— 2·87	·30	7	10	52·0	7, 25	25·0	24	9	...
,,	Llandudno ...	·41	— 2·54	·15	20	10	55·0	2	35·0	31	0	...
XII.	Cargen [Dumfries] ...	2·02	— 2·66	·68	5	12	52·0	2	28·0	13, 26	...	...
,,	Lilliesleaf (Riddell) ...	·87	— 2·31	·32	25	12	50·0	6	25·0	26, 27	8	8
XIII.	Edinburgh (Royal Observy.)	1·27	...	·31	25	14	53·2	7	27·0	24	4	6
XIV.	Colmonell ...	3·81	— 1·01	1·12	24	18	52·0	3	28·0	11	4	...
XV.	Tighnabruaich ...	4·46	— 1·87	·67	24	18	46·0	3, 4	28·0	30	6	6
,,	Mull (Quinish) ...	5·37	— 1·11	·85	5	22	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	1·25	— 1·48	·35	24	15	52·3	3	31·2	12	3	...
XVII.	Braemar ...	2·02	— 1·13	·68	5	17	50·8	4	20·2	30	...	...
,,	Aberdeen (Cranford) ...	·94	— 2·45	·21	16	16	53·0	3, 4	23·0	12	8	...
,,	Cawdor (Budgate) ...	1·24	— 1·29	·36	7	11	...	...	...	...	...	...
XVIII.	Invergarry ...	6·29	— ·38	1·80	6	10	...	...	...	...	...	...
,,	Bendamph ...	9·36	+ ·32	1·83	5	26	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	1·67	— 1·72	·33	6	14	56·0	2	28·5	7	6	...
,,	Castletown ...	2·04	...	·34	29	22	53·0	2	26·0	26, 31	5	9
XX.	Killarney ...	5·38	— 1·26	1·28	25	19	56·0	7	33·0	13	0	...
,,	Waterford (Brook Lodge)...	1·86	— 2·45	·40	27	14	54·0	25	26·0	10	2	...
,,	Broadford (Hurdlestown) ...	1·85	— 1·52	·32	24	20	60·0	4	30·0	9	1	...
XXI.	Carlow (Browne's Hill) ...	1·93	— 1·53	·36	18	18	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·26	— 1·13	·27	18	13	55·6	25	34·0	10	0	1
XXII.	Ballinasloe ...	2·44	— 1·19	·51	24	21	...	...	...	...	...	...
,,	Clifden (Kylemore House)..	6·04	— 2·95	1·36	18	17	...	...	...	...	...	...
XXIII.	Seaforde ...	2·89	— ·75	·71	18	18	51·0	2, 25	30·0	9	2	2
,,	Londonderry (Creggan Res.)	2·83	— 1·48	·68	24	21	...	...	...	...	...	...
,,	Omagh (Edenfel) ...	3·39	— ·38	·60	24	22	52·0	2	33·0	9	...	3

† Shows that the fall was above the average; — that it was below it. *a* and 11 31

SUPPLEMENTARY RAINFALL, DECEMBER, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	·76	XI.	New Radnor, Ednol	1·35
,,	Ramsgate, West Cliff	·25	,,	Rhayader, Nantgwillt	2·26
,,	Hailsham	1·15	,,	Lake Vyrnwy	1·42
,,	Crowborough	1·28	,,	Ruthin, Plâs Drâw	·61
,,	Osborne	·84	,,	Criccieth, Talarvor	1·20
,,	Emsworth, Redlands	·73	,,	Anglesey, Lligwy	1·05
,,	Alton, Ashdell	·85	,,	Douglas, Woodville	1·74
,,	Newbury, Welford Park	1·34	XII.	Stoneykirk, Ardwell House	1·23
III.	Harrow Weald	·96	,,	Dalry, Old Garroch	6·14
,,	Oxford, Magdalen College	·84	,,	Langholm, Drove Road	3·29
,,	Banbury, Bloxham Grove	·98	,,	Moniaive, Maxwelton House	3·61
,,	Pitsford, Sedgebrook	·78	XIII.	N. Esk Reservoir [Penicuick]	2·80
,,	Huntingdon, Brampton	·95	XIV.	Maybole, Knockdon Farm	3·54
,,	Wisbech, Bank House	·68	,,	Glasgow, Queen's Park	3·38
IV.	Southend	·57	,,	Campbeltown, Redknowe	3·17
,,	Colchester, Lexden	·61	XV.	Inveraray, Newtown	7·66
,,	Saffron Walden, Newport	·77	,,	Ballachulish House	8·19
,,	Rendlesham Hall	1·04	,,	Islay, Eallabus	4·28
,,	Swaffham	·92	XVI.	Dollar	3·70
,,	Blakeney	·90	,,	Loch Leven Sluices	3·18
V.	Bishops Cannings	1·09	,,	Balquhidder, Stronvar	7·66
,,	Ashburton, Druid House	1·87	,,	Coupar Angus	1·54
,,	Okehampton, Oaklands	1·85	,,	Blair Atholl	2·30
,,	Hartland Abbey	1·32	,,	Montrose, Sunnyside	1·45
,,	Lynmouth, Rock House	1·69	XVII.	Alford, Lynturk Manse	·75
,,	Probus, Lamellyn	1·99	,,	Keith	·83
,,	Wellington, The Avenue	·97	XVIII.	N. Uist, Lochmaddy	3·74
,,	North Cadbury Rectory	·90	,,	Aviemore, Alvey Manse	1·61
VI.	Clifton, Pembroke Road	1·13	,,	Loch Ness, Drumnadrochit	2·51
,,	Moreton-in-Marsh, Longboro'	1·11	,,	Glencarron	9·33
,,	Ross, The Graig	·56	,,	Fearn, Lower Pitkerrie	1·04
,,	Shifnal, Hatton Grange	·99	XIX.	Invershin	1·95
,,	Wem Rectory	·50	,,	Altnaharra	3·48
,,	Cheadle, The Heath House	·74	,,	Bettyhill	2·64
,,	Coventry, Kingswood	1·54	,,	Watten	1·37
VII.	Market Overton	·65	XX.	Cork	3·58
,,	Market Rasen	·51	,,	Darrynane Abbey	4·31
,,	Bawtry, Hesley Hall	·32	,,	Glenam [Clonmel]	3·13
VIII.	Neston, Hinderton	·55	,,	Ballingarry, Gurteen	2·00
,,	Southport, Hesketh Park	·62	,,	Miltown Malbay	2·59
,,	Chatburn, Middlewood	1·43	XXI.	Gorey, Courtown House	1·37
,,	Cartmel, Flookburgh	1·52	,,	Moynalty, Westland	2·74
IX.	Langsett Moor, Up. Midhope	1·27	,,	Athlone, Twyford	1·91
,,	Scalby, Silverdale	·66	,,	Mullingar, Belvedere	2·86
,,	Ingleby Greenhow	·49	XXII.	Woodlawn	3·14
,,	Middleton, Mickleton	1·08	,,	Westport, Murrisk Abbey	3·53
X.	Beltingham	1·12	,,	Crossmolina, Enniscoe	5·53
,,	Font Reservoir, Fallowlees	1·38	,,	Collooney, Markree Obsy	3·46
,,	Ilderton, Lilburn Cottage	·52	XXIII.	Enniskillen, Portora	2·89
,,	Keswick, The Bank	3·34	,,	Warrenpoint	1·63
XI.	Llanfrechfa Grange	1·28	,,	Banbridge, Milltown	1·61
,,	Treherbert, Tyn-y-waun	3·33	,,	Belfast, Springfield	2·78
,,	Carmarthen, Friary	1·77	,,	Bushmills, Dundarave	2·77
,,	Castle Malgwyn	1·53	,,	Stewartstown	2·47
,,	Plynlimon	4·80	,,	Killybegs	3·15
,,	Tallyllyn	3·00	,,	Horn Head	3·90

METEOROLOGICAL NOTES ON DECEMBER, 1905.

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

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Mild with fairly uniform temp. and great deficiency of sunshine and R. Although the prevailing type of weather was anticyclonic, there was practically no frost and the mean temp. was 41°·0, or 1·8 above the average. Dense fogs occurred in London on 10th and 11th, but on no other day. Duration of sunshine 12·4* hours and of R 28·4 hours. Absolute drought for 18 days from 9th to 26th.

TENTERDEN.—Dull with some fog and very deficient R, though the first week was showery. Brilliant sunshine on 6th, from 9th to 11th, and on Christmas Day, but on only 6 other days, the total duration amounting to 39·7† hours.

CROWBOROUGH.—Dark and gloomy with much mist and deficient R. With the exception of some slight frosts from 9th to 12th and severe frost on 31st, the weather was mild. Absence of strong winds. Mean temp. 39°·3.

OSBORNE.—R about two inches below the average of 48 years and the smallest in December since 1890.

HARTLEY WINTNEY.—The driest December ever recorded. Fog and slight showers prevailed during the first week, but the remainder was beautifully fine, dry and warm. Ozone on 13 days with a mean of 3·1.

BURY ST. EDMUNDS.—Dull and foggy with no sharp frosts. Water was very short in rivers, ponds and deep wells.

BLAKENEY.—R 1·15 in. below the average of 12 years and the lowest in that period. From 9th to 27th, inclusive, only ·03 in. of R fell.

ALDERBURY.—Although there was very little R, there was great humidity of the atmosphere and roads were unusually and persistently muddy. Much fog and mist.

TORQUAY.—The driest December since 1883. Mean temp. 45°·1, or 1°·5 above the average. Duration of sunshine 49·9* hours, or 3·4 hours below the average. Mean amount of ozone 3·8; max. 6·5 on 19th with S.W. wind and on 27th with S.E. wind; min. 1·0 on 4th with N.E. wind.

WELLINGTON.—A great contrast to November, being exceptionally dry with few rough days and an equable temp. from 9th to the end, the max. being always between 40° and 50°. R about one-fourth of the average.

NORTH CADBURY.—The calmest month in 9 years and the driest December in 10 years, the fall being less than half that of the previous driest. Almost absolute calm prevailed for a complete week from 10th to 16th. The mean min. temp. was above that of November and only just below that of October.

CLIFTON.—R 2·25 in. below the average. From 5th to 8th was rainy, but the remainder dry and dull, with a good deal of fog till 13th. Very little frost.

STROUD.—Fine, mild and warm with bright sunshine. Primroses were in bloom and snowdrops in bud.

ROSS.—The least R in December since 1818 except in 1840, when only ·33 in. fell. Mean temp. 39°·8, or slightly above the average of 40 years.

WOOLSTASTON.—Dry on the whole and favourable for out-door work. Some fog, but not an excessive amount.

WORKSOP.—The driest December for 31 years, though in 1892 there was only ·01 in. more.

BOLTON.—Mild, cloudy and misty with no frost in the screen till 28th. A great number of calm days. Mean temp. 40°·6, or 1°·9 above the average. Duration of sunshine 11·4* hours, or 3·9 hours below the average.

SOUTHPORT.—In several respects a remarkable month. It was the driest December in 35 years, with exceptionally high mean bar., and abnormal equability of temp., due to absence of low minima. It was, however, notable for

* Campbell-Stokes. † Jordan.

the largest amount of sunshine recorded in December, having 22 hours more than the average. Mean temp. 2°·8 above the average.

UPPER MIDHOPE.—Mild, open and very dry till 27th, wet on 28th and 29th, wintry on 30th and 31st. The driest December since 1892. Windy on 22 days and stormy on 9. Fog on 7 days and 6 nights.

NEWCASTLE.—The smallest R in December since 1873, when ·39 in. fell.

LILBURN COTTAGE.—Extremely dry and mild, but cold at the end. The atmosphere was generally clear with a large amount of sunshine. No gales.

LLANFRECHFA GRANGE.—Fine and mild, with less than a third of the usual amount of R, which was much wanted for springs. Agricultural work was well forward and root crops were good.

CARMARTHEN.—Remarkably dry and fine. Grass was growing during the month and many meadows looked quite green and spring-like.

HAVERFORDWEST.—Wet until 7th, after which it was mostly fine and mild, strawberries and primroses being in bloom. Duration of sunshine 38·1* hours. Gales on 5 days.

DOUGLAS.—Fine and open with no frost or fog and many beautiful days. By far the driest December since records began in 1874. The mean bar. was abnormally high, reaching 30·88 in. on 12th. There were no violent gales but an excess of rough nights, and severe E. gales on 30th and 31st, which destroyed all garden flowers, of which there were an unusual number.

SCOTLAND.

LANGHOLM.—R 2·33 in. below the average of 28 years.

LILLIESLEAF.—Very mild and dry. Hunting was not prevented for a single day during the season so far. Ploughing was well forward and farmers quite contented.

INVERARAY.—Very wet till 24th, after which there were a few pleasant, fine and very mild days, the month ending with E. wind and slight frosts.

MULL, QUINISH.—Mild, wet and unsettled till 23rd; thereafter cold and dry with strong S.E. wind.

COUPAR ANGUS.—Favourable weather to 11th with little R and a fair amount of sun, but during the last two weeks, although the temp. kept well above the normal, the incessant light R and cloudy weather kept the roads wretched. There were no storms or gales. Mean temp. 40°·4.

DRUMNADROCHIT.—R 1·74 in., and rainy days 2, below the average of 19 years. The latter half genial, with frost on the last few days. No S so far at this level.

WATTEN.—Fresh and open. The last three weeks were dry and mild.

CASTLETOWN.—The early part was mild and wet with fresh gales from 7th to 9th. Then mild and damp till the last few days when it became colder. Practically no S.

IRELAND.

CORK.—Dull, dark, foggy and mild. Frost occurred in the screen on one day only, and the mean temp. was 4°·4 above that of November. Half the total R fell on the last two days.

DARRYNANE ABBEY.—R only 80·1 per cent. of the average, the first two weeks being dry.

WATERFORD.—The driest December since 1883.

HURDLESTOWN.—The driest December on record here.

MILTOWN MALBAY.—Mild, with no frost and R far below the average. Heavy S.E. gale on 30th and 31st.

DUBLIN.—An open month with southerly winds and cloudy sky, closing with a cold S.E. gale, darkness and R. Mean temp. 47°·1.

BANBRIDGE.—R 1·20 in. below the average of 40 years.

BELFAST.—Dull and foggy with hardly any frost and R considerably under the average.

OMAGH.—The weather was remarkably mild with no S and no frost, constituting a record for December.

Climatological Table for the British Empire, July, 1905.

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	85·3	26	49·8	7	78·5	57·7	57·5	73	134·6	44·4	·96	8	4·9
Malta	94·7	7	68·9	16	88·1	72·7	71·3	77	141·7	63·5	·63	2	1·9
Lagos	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	75·8	15	41·4	11	64·9	52·2	50·8	76	...	...	2·46	10	4·8
Durban, Natal	83·9	11	47·3	9	75·4	53·7	...	...	133·9	...	·71	4	1·7
Johannesburg	66·5	2	30·5	16	60·6	41·2	34·0	61	121·0	12·0	·00	0	0·4
Mauritius	79·1	6	56·5	20	75·9	62·7	60·8	77	139·8	47·5	1·62	14	6·1
Calcutta	93·9	16	74·7	7	88·3	78·1	77·5	86	161·2	73·0	24·84	19	8·8
Bombay	88·2	9	75·4	23	85·4	78·8	77·0	84	133·7	73·8	15·30	28	8·9
Madras	104·9	3	75·6	29	100·3	80·2	71·7	64	148·3	72·6	2·31	15	5·9
Kodaikanal	69·4	4	49·7	7	64·6	52·7	50·2	76	146·6	41·7	2·68	14	6·3
Colombo, Ceylon	87·4	8*a*	76·5	19	86·4	78·6	74·2	80	145·5	74·2	1·25	13	5·4
Hongkong	91·3	18	73·8	7	87·8	78·1	75·4	80	147·5	...	9·02	16	6·3
Melbourne	62·9	21	35·0	4	54·8	43·0	41·3	77	117·8	27·6	3·28	19	6·9
Adelaide	66·0	8	36·3	31	58·2	45·0	45·6	78	120·0	31·2	3·32	22	6·2
Coolgardie	71·2	27	32·9	12	63·2	46·0	38·4	61	139·2	24·2	·29	5	3·0
Sydney	70·0	...	38·6	...	59·1	44·4	39·4	72	98·2	29·3	·39	13	2·6
Wellington	62·9	23	33·2	3	...	...	41·1	74	100·0	29·5	2·19	14	5·8
Auckland	60·0	23*b*	40·0	3, 10	55·7	44·6	44·3	81	117·0	36·0	3·88	18	5·7
Jamaica, Negril Point	91·6	15*c*	70·1	2	88·2	73·0	72·7	75	...	...	3·53	12	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	85·6	5, 14	69·0	26	83·7	74·9	72·3	80	144·2	...	10·28	28	4·8
Toronto	92·1	18	51·3	21	78·8	60·6	61·7	76	...	45·4	4·72	14	5·5
Fredericton	87·7	8*d*	46·0	23	79·2	55·1	55·7	59	...	...	1·76	6	5·2
Winnipeg	86·8	10	46·0	8	76·6	54·0	...	...	...	...	4·35	8	4·5
Victoria, B.C.	84·2	8	50·5	2	69·0	53·5	...	...	...	...	·10	4	2·4
Dawson	83·6	20	35·0	7	70·8	47·8	...	...	...	...	1·93	7	4·6

a and 28, 30. *b* and 24. *c* and 19. *d* and 9, 13.

MALTA.—Mean temp. of air 79·1, or 1·4 above average. Mean temp. of sea 81·8. Mean hourly velocity of wind 6·4, or 1·0 below average.

Mauritius.—Mean temp. of air 1°·1, dew point 1°·4 above, and rainfall ·57 in. below, averages. Mean hourly velocity of wind 9·6 miles, or 2·4 below average.

MADRAS.—Bright sunshine 172·8 hours.

KODAIKANAL.—Bright sunshine 170 hours. Mean daily velocity of wind 389 miles.

COLOMBO.—Mean temp. 82·1 or 1·5 above, of dew point 0°·9 above, and R 3·26 in. below averages. Mean hourly velocity of wind 8·4 miles; prevailing direction S.W.

HONGKONG.—Mean temp. of air 82·3. Mean direction of wind S.S.E., and mean hourly velocity 7·8 miles. Bright sunshine 243·5 hours, or 43 hours above average, and R 4·30 in. below 20 years' average.

Adelaide.—R ·78 in. above average.

Sydney.—R 4·26 in. below average.

Wellington.—R 3·64 in. below average.

Auckland.—Mean temp. of air 2° below, and R 1·00 in. below, averages.

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