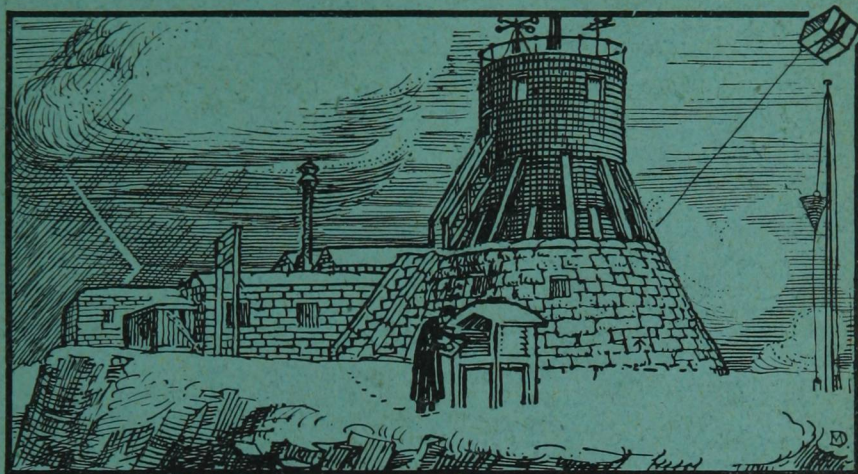


NO. 545 SYMONS'S VOL. 46

METEOROLOGICAL

• MAGAZINE •

••• EDITED BY HUGH ROBERT MILL •••



JUNE, 1911.

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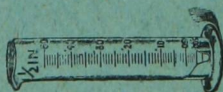
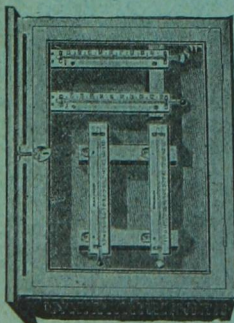
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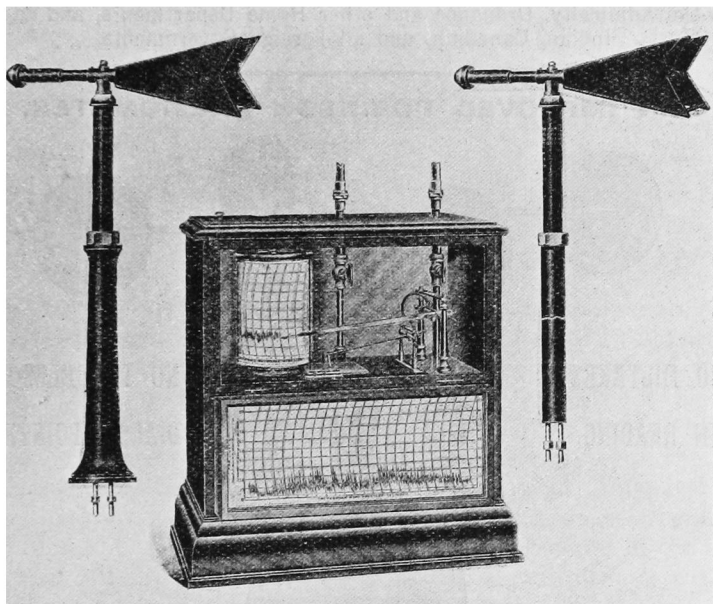
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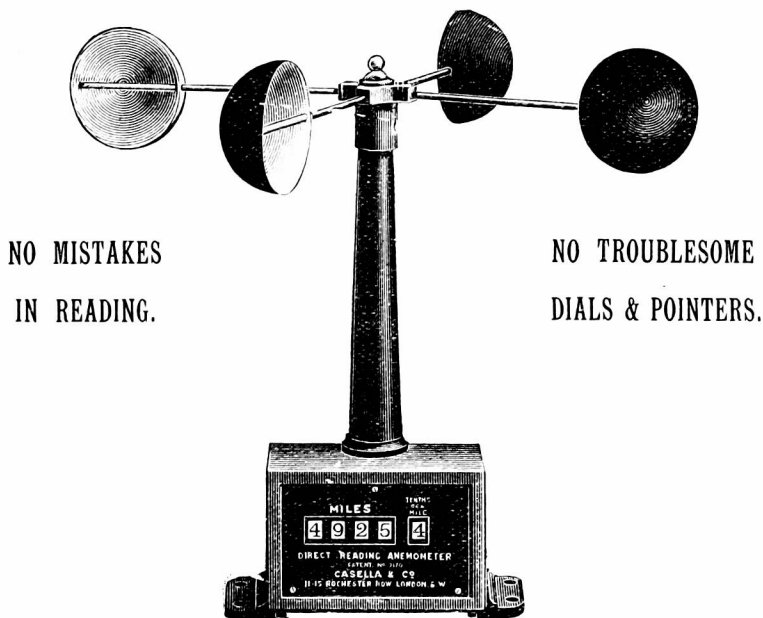
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Symons's Meteorological Magazine.

No. 545.

JUNE, 1911.

VOL. XLVI.

DISTRIBUTION OF RAIN IN A BAROMETRIC DEPRESSION.

By R. CORLESS, M.A.

IT has become one of the commonplaces of synoptic meteorology that the heaviest rain usually falls on the left-hand side of the path of the centre of a depression as one looks in the direction of motion of that centre. This appears to be true, in general, not only for depressions which move eastward or northward, but also for those that move towards the west or south. Dr. H. R. Mill's maps of the rainfall which was persistent in London for three days in June, 1903, are a good illustration of the rule.* On that occasion the centre of a depression almost completely circumnavigated London in the counter-clockwise direction, so that the metropolis was always within the area of the depression to the left of its centre.

I think the following considerations may help us to understand a reason for the phenomenon.

For the sake of argument, we may consider a depression in which the wind is blowing tangentially to the isobars. Such an arrangement is possibly never met with at the surface, but the evidence of kite ascents goes to show that at a certain height, say 1,500 feet, the conditions are not dissimilar to those supposed. Let us therefore consider what happens at 1,500 feet above the surface.

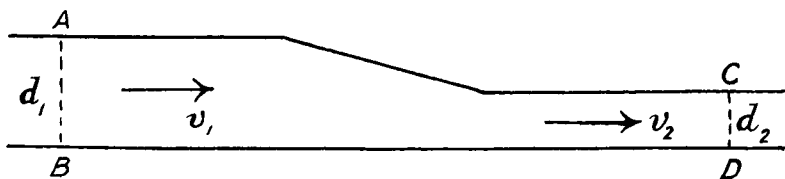
The velocity of the wind (v) may be found from the ordinary formula connecting wind and pressure gradient (see, *e.g.*, Meteorological Office publication, "Barometric gradient and wind force," where it is shown that there is usually very fair agreement between the actual wind at from 1,500 to 3,000 feet and the theoretical wind as computed from the distribution of pressure at sea-level). For our immediate purpose all that is required is that when the path of the air is straight, the relation

$$vd = \text{constant}$$

holds good between the wind velocity and d , the distance between consecutive isobars. When the path is curved cyclonically the value of v as determined from this equation is theoretically too large,

* See this Magazine, Vol. 39 (1904), pp. 161-165, for the first statement of the generalization and for the maps referred to.—ED. S.M.M.

and the error increases with increasing curvature of the path. Now, we are assuming that at any instant the air moves tangentially to the isobars, so that at any given moment we may suppose that the surface isobars are the sections of a series of impermeable vertical partitions in the air, cut off by a horizontal plane at the 1,500 feet level, and that the air at that level is instantaneously moving in the channels thus formed. Looked at in this way, an interesting point arises. For the equation, $vd = \text{constant}$, is also exactly the condition that air should move horizontally along the channels without rising or sinking. This may be seen by considering a simple case.



Imagine that water is flowing steadily along a channel, of which the figure is a plan. At AB the cross-section d_1 of the channel is double that (d_2) at CD. It is evident that so long as the surface of the water remains horizontal (*i.e.*, so long as the motion is all in horizontal planes) the velocity (v_1) at AB is half that (v_2) at CD.

Thus, $d_1 = 2d_2$ and $v_1 = \frac{1}{2}v_2$, hence $v_1d_1 = v_2d_2$

and similarly, in general, vd is constant at all parts of the channel. The argument is similar in the case of air flowing horizontally. Thus (1) so long as the paths or trajectories of air are straight, we expect to find that the air moves entirely in horizontal planes.

Now, suppose that air which was originally moving in a straight trajectory is deflected cyclonically. We have already stated that the theoretical value of the wind in such a region is less than the value given by $vd = \text{constant}$. Returning to our water analogue, this means that at a part of the channel where it is curved the water does not move as rapidly as the water in the straight portion behind would like it; the result is that it tends to become piled up in the curved portion, and gravity only would prevent it from accumulating there. On the air, however, the effect of gravity is relatively feeble, and the superfluous air finds an easy escape. It cannot move sideways, and it is clear that it cannot move downwards over a large region; consequently it has no alternative but to rise. Thus (2) whenever the curvature of the trajectory of air increases, part of the air will rise. An upward current of air is admittedly the only way in which any appreciable amount of rain can be formed.

It remains to see that the conditions of (1) more nearly occur on the right, while those of (2) occur on the left of the path of the centre of a depression, no matter in what direction the depression is travelling. Although we likened the isobars to vertical partitions in the air, it is very important to remember that the partitions were

required only for an instant of time, and indeed it would be misleading to suppose that the motion of the air taking part in a cyclone is represented by causing it continually to flow between fixed vertical partitions erected upon the isobars. This matter is very fully dealt with by Shaw and Lempfert in "The Life History of Surface Air Currents," where it is shown that surface air may move over long distances in nearly straight lines (*i.e.*, great circles), in spite of the fact that the air may be continuously within the area of the closed isobars of a depression.

It may not be without interest to give a simple illustration of this effect. Suppose that the centre of a depression is moving from west to east at a rate of 20 miles an hour, and that a particle of air initially due south of the centre is also moving at 20 miles an hour. If the motion is along the isobars the particle will also be moving initially from west to east. At the end of an hour the particle would have moved a little north of east if the centre of the depression was at rest, but as the centre is actually moving at the same speed as the particle it is evident that the direction of the line joining the particle to the centre always remains due north and south, and therefore that the particle continues to move due east in a straight line parallel to the path of the centre, and at the same speed as the centre. In this case the curvature of the trajectory entirely disappears.

In a similar way it is easy to see that the curvature of the path of every particle, which would be that of its isobar if the depression was at rest, is always less than that of the isobar on the south side of the depression, and greater than that of the isobar on the north side of the depression, whenever the depression is moving eastward. It is also clear, on the other hand, that the greater curvature will be on the south side and the less on the north if the depression is moving in the opposite direction, from east to west; and, in general, that the less curvature is on the right of the path, and the greater curvature on the left, no matter in what direction the centre is moving. The diagrams of trajectories in "The Life History of Surface Air Currents" bring out this fact very clearly, and Gold, in "Barometric Gradient and Wind Force," gives a note showing how to compute the curvature of the trajectory in any given case.

We have seen reason to suppose that ascending air in a depression takes place at a point where the curvature of a trajectory is increasing, and we have also seen that the maximum curvature is on the left-hand side of the path of the centre. Accordingly, the front quadrant of the depression situated on the left side of the path is the region where we expect to find air ascending in appreciable amount, and this is the region where heavy falls of rain actually occur.

Of course, rain falls in many other parts of a depression, but the origin of such precipitation may be quite different from that here suggested, and would not affect the general argument outlined above.

THE PROBABLE RAINFALL IN THE NORTH-EAST OF ENGLAND DURING THE PRESENT SUMMER.

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

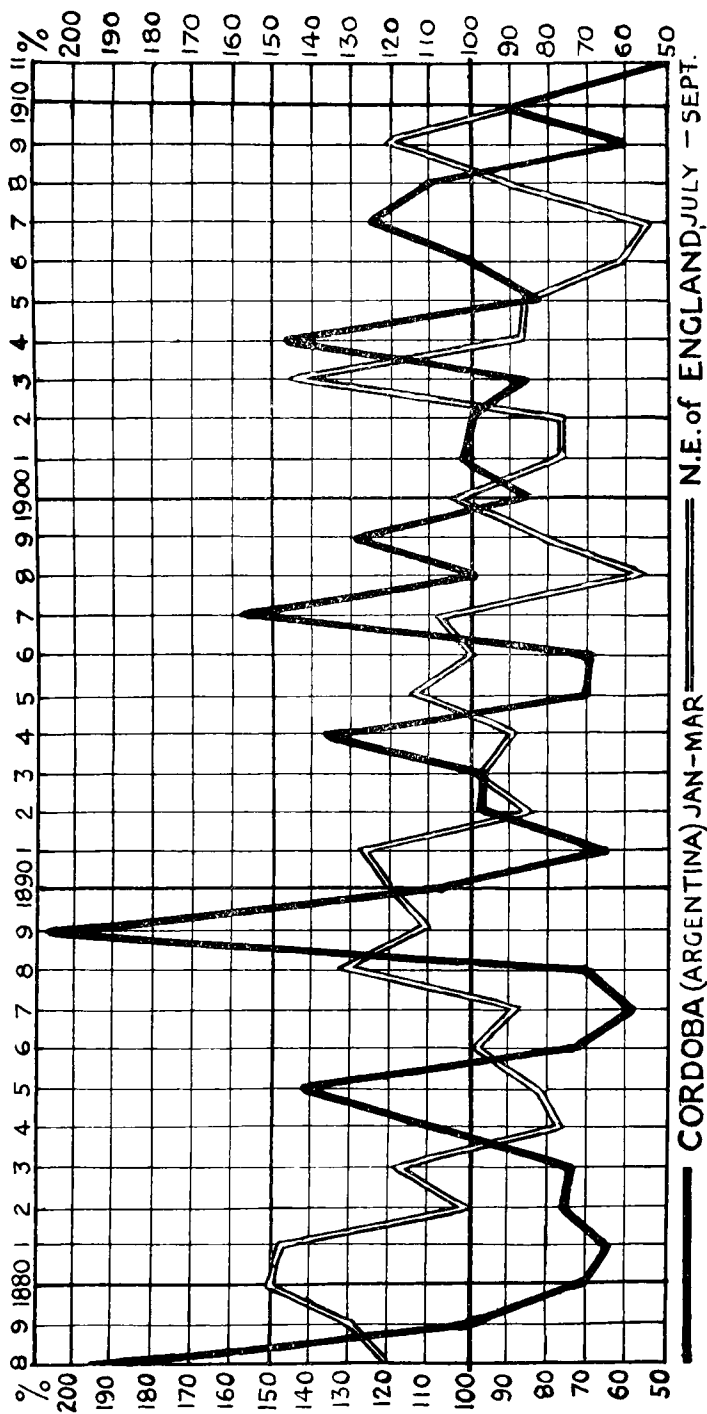
ON comparing the aggregate rainfall at Cordoba, Argentine Republic, for the first quarter of the year since 1878, with that over the north-west of England for the succeeding third quarter of the year, it is seen that the values are in general the reverse of each other, that is that when the rainfall during the first quarter of the year at Cordoba is in excess of the normal, then the rainfall of the third quarter of the year is in defect over the north-east of England, and *vice versa*. The following are the values expressed in inches, these being given in the diagram as percentages above or below the normal for the 33 years, 1878-1910.

	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
	in.	in.	in.	in.	in.	in.	in.	in.	in.
Cordoba	23.0	11.9	8.4	7.6	8.9	8.7	13.0	16.9	8.7
(Jan.—March.)									
N.E. England	8.4	9.0	10.5	10.3	6.9	8.3	5.3	5.7	6.8
(July—Sept.)									
	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
	in.	in.	in.	in.	in.	in.	in.	in.	in.
Cordoba	6.7	8.3	24.4	12.6	7.7	11.4	11.3	16.1	8.2
N.E. England	6.1	9.2	7.7	8.3	8.8	6.6	6.8	6.2	7.9
	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
	in.	in.	in.	in.	in.	in.	in.	in.	in.
Cordoba	8.0	19.0	11.1	15.2	10.0	11.9	11.7	10.0	17.3
N.E. England	6.9	7.4	3.8	5.6	7.3	5.4	5.4	10.1	6.1
	1905.	1906.	1907.	1908.	1909.	1910.	1911.		
	in.	in.	in.	in.	in.	in.	in.		
Cordoba	9.7	11.9	14.6	12.8	6.9	10.4	5.5		
N.E. England	5.8	4.4	3.8	6.2	8.3	6.3	—		

During the first quarter of this year the rainfall from January to March at Cordoba was only 5.5 inches against an average of 11.9 inches, being thus only 46 per cent. of the normal. On ten occasions since 1878 the rainfall at Cordoba for the first quarter of the year has fallen 25 or more per cent under the average. In these years the average rainfall over the north-east of England in the third quarter of the year was 19 per cent. above the normal. There was one failure, viz., in 1887, when the rainfall of Cordoba was 43 per cent. in defect, and in the north-east of England 13 per cent. in defect. In 1882, 1886 and 1896, dry weather prevailed at Cordoba, but in the specific district of England under discussion rainfall was normal. On the other hand, 1880, 1881, 1883, 1891, 1895, and 1909 show pronounced opposition in the rainfall curves at the two places, thus in the ten years which were characterised by deficient

Data for Cordoba till 1898 have been obtained from "Anales de la Oficina Meteorologica Argentina," Tomo XIII., p. 504, and from MS. after 1898. The values for England, N.E., from Vol. 32 of the "Weekly Weather Report of the Meteorological Office," Appendix 1.

PERCENTAGE OF THE AVERAGE RAINFALL 1878-1910. AT CORDOBA (ARGENTINA) JAN-MAR & FOR N.E. ENGLAND JULY-SEPT.



THAMES VALLEY RAINFALL — MAY, 1911.



Symons's Meteorological Magazine.

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

Rainfall Stations reporting
Isohyetals.

ALTITUDE
SCALE

SCALE OF MILES



rainfall at Cordoba during the first three months, six of the succeeding summers (July—September) were wet in the north-east of England, three had a rainfall very slightly under the average, and one was dry. On the whole, therefore, there is a distinct suggestion that the coming summer will have a rainfall in excess of the normal over the north-east of England.

THE THUNDERSTORMS OF MAY, 1911.

THANKS in no small measure to the admirable organization of the rainfall work of the Croydon Natural History Society in the hands of Mr. F. Campbell Bayard, we have been enabled only a few days subsequent to the event to study in considerable detail the distribution of rainfall in the thunderstorms which occurred in the home counties on May 31st, and which, no doubt on account of the coincidence with the time and place of the gathering together of the Derby-day crowds, received possibly an undue share of attention in the press. We have no great amount of information respecting the time of the storms, but there seems little doubt that these took place at a much earlier hour to the north of London than in the town itself and in Surrey, where the time is stated to have been generally between 5 and 8 p.m. A map of the rainfall of May 31st shows that on that day rain of any importance was confined to a comparatively narrow belt of country stretching from Hitchin on the north to Reigate and Tonbridge on the south. Within this there were two strips of comparatively heavy rain; a continuous strip on the western side from Reigate to Hitchin with more than 50 in., and a string of detached splashes running parallel to it on the eastern side from Tonbridge to Enfield. In the western strip 1·00 in. or more fell in five almost equidistant splashes, the most northerly of which appears to have been near Hitchin, and the most southerly between Dorking and Reigate. The heaviest rainfall, so far as we can ascertain, took place over the North Downs, culminating at Banstead, where two stations show records of 3·59 in. and 3·54 in. respectively. At Epsom 2·86 in. fell between 5.20 and 8 p.m., of which 2·44 in. fell from 5.20 to 6.10 p.m. At Chipstead 3·00 in., and at Blechingly 2·97 in. were also measured. In the eastern line of heavy rainfall splashes no such great amounts were reported, the maximum being 1·60 in., which fell between 6.30 and 7.30 p.m. at Sevenoaks.

Apart from the excessive rainfall over Banstead Downs, the most unusual feature of the storm of May 31st seems to have been the long continuance and intensity of the electrical discharges and the large number of casualties resulting from lightning. Want of space renders it impossible to give details of these, but it is interesting to observe that accidents were, on the whole, more numerous where the rainfall was slight, a result possibly of the relief to electrical tension brought about by the rain itself.

Little less remarkable from the point of view of rainfall were the storms of May 25th and 26th. For purposes of mapping, the falls of the two days were taken together, and it was found that a broad band, over which more than 1·00 in. fell, running from north to south across the middle Thames Valley, constituted the main feature. A smaller and, probably, detached splash lay between Basingstoke and Winchester. The most remarkable storm lay at the extreme south of these larger splashes, being localized at Fareham, where, at Roche Court, 1·09 in. fell on the 25th and 2·92 in. on the 26th, the latter fall taking place entirely between 3 and 5 p.m., whilst at The Mount the falls were ·79 in. and 3·13 in. ; on the 26th 3·00 in. fell in one hour from 2.45 to 3.45 p.m. Great damage to roads and fields resulted. At Rochford, Worcestershire, 3·06 in. fell on the 26th, whilst not more than ten miles away, at Bewdley, only a tenth of an inch was measured.

The rainfall distribution during May in the south of England was entirely dominated by the precipitation of these three days, though other thunderstorms of a less violent nature took place round the 11th, and considerable rain fell in some places on the 30th also.

The foregoing map of the rainfall of the Thames Valley for May shows two bands running north and south with more than 2 inches of rain ; the western due to the storms of the 25th and 26th, the eastern to that of the 31st.

From the north Midlands complaints continue to come of the great shortage of rainfall during the present year. At Wakefield the total fall from January 1st to May 31st amounted to 3·94 in., or little more than fell in a couple of hours at some spots on May 31st.

THE WEATHER OF MAY.

By FRED. J. BRODIE.

OWING to frequent changes in the type of pressure distribution, the weather of May could seldom be regarded as altogether settled. Many fine spells were, however, experienced, and as the thermometer was, as a rule, above its average level, the month presented itself in a more favourable guise than in many recent years.

During the first few days, when a rather deep cyclonic disturbance moved slowly eastwards from Iceland, the weather in this country was influenced by "V-shaped" depressions passing also from west to east, and causing frequent falls of rain in most districts. Temperature was below the normal, and early on the 1st and 2nd frost occurred rather extensively, the sheltered thermometer falling slightly below 32° at several places in the west and north. On the grass the frost was more general, and locally rather severe, the minimum readings being as low as 23° at Crathes, 24° at Burnley, 25° at Balmoral and 26° at Durham and Colmonell. Between the 5th and 8th, when an anticyclone came in from the Atlantic and joined

another high pressure system previously existing over northern Europe, the weather improved and the thermometer rose to about its average level. Night frosts were, however, experienced between the 7th and 9th, the grass minima being as low as 27° at Kew and Rauceby, and 28° at Greenwich, Wisley and Tunbridge Wells. After the 9th the anticyclone gradually withdrew to the northward, and for the next three or four days the conditions were influenced by a large and rather complex area of low pressure which spread up from France and Spain. Thunderstorms commenced in the south-west of England on the 10th and afterwards extended over a large portion of the kingdom, the accompanying rainfall being, in many places, very heavy. Temperature, however, continued to rise, and between the 10th and 13th maximum readings of 70° , and upwards, were recorded very generally, the thermometer touching 75° at Tottenham, Margate, and Fort William, 76° at Greenwich and in the west of Scotland (at P'oltalloch and Colmonell), and, on the 10th, 79° at Camden Square. About the middle of the month the pressure distribution was rather variable, and the weather mostly fair, with, however, a good deal of fog and mist round the coasts.

The cold snap which is so often experienced about the second week in May had hitherto been conspicuous by its absence. In a mitigated form it put in a belated appearance between the 18th and 21st of the month, when a brisk wind swept down from the northward, and caused a decided fall of temperature in all parts of the country. At many places in the east and south-east of England the maximum readings of the 18th—20th were scarcely above 50° , and at Lowestoft, on the 18th, the thermometer did not exceed 49° . Ground frost occurred very generally on the nights of the 19th to 21st, the grass minima being as low as 24° at Llangammarch Wells, 25° at Greenwich and at Crathes, and 26° at Balmoral and Burnley.

For the remainder of the month the type of weather was mainly anticyclonic and the general conditions fair, warm, and very dry. A rather important break occurred, however, on the 26th and 27th, when an area of low pressure spread northwards from France and occasioned thunderstorms in many districts, with exceedingly heavy falls of rain in some parts of central and southern England. The temperature of the last ten days was almost continuously above the average, and between the 28th and 31st the thermometer touched 80° in many scattered parts of Great Britain, a reading of 83° being recorded on the 29th at Balmoral and Fort William, and a reading of 82° at Greenwich and Camden Square on the 31st. Thunderstorms occurred on the last day in several parts of England.

The mean temperature of the month was above the average; in parts of Scotland and Ireland it was, in fact, the highest recorded in May since 1896, while in London and some other portions of inland England it was higher than in any May of the previous 40 years. The total duration of bright sunshine was nearly everywhere in excess of the normal, but, as a rule, the excess was not large.

ROYAL METEOROLOGICAL SOCIETY.

THE first of the afternoon meetings for the present session was held in the Society's rooms, 70, Victoria Street, Westminster, on Wednesday, May 17th, Dr. H. N. Dickson, President, being in the Chair.

Dr. H. R. Mill and Mr. C. Salter read a joint paper on "The Frequency and Grouping of Wet Days in London." The purpose of this paper was to place on record certain facts derived from the long rainfall record of 52 years, kept at Camden Square, bearing on a recent scheme for insurance against rain risks. Certain aspects of this insurance scheme were dealt with in *Symons's Meteorological Magazine* for April (p. 41-45), and nothing has since arisen to alter the opinion there expressed as to the crudity of the scheme under consideration. In this paper only days with a rainfall exceeding .20 in. (which the authors called, for the purpose of this paper only, a "wet day") are dealt with, and the discussion is strictly applicable to London only.

The average number of days with more than .20 in. of rain is 40 per annum, the average number of "rain days" being 163, so that practically there is in every four "rain days" one "wet day," under the above definition. The smallest number of "wet days" was 27 in 1864 and 1898, and the largest, 58, in 1879. A table was also included which stated the number of instances on which each day of the year had been a "wet day" in the 52 years. One day only, February 18th, never had a fall reaching the limit of .21 in. On July 27th and October 27th, however, such falls had occurred 13 times, and during the fortnight ending either on October 29th, 30th, or 31st, or November 7th, the number of occasions averaged 8.5 per day. After giving a detailed account of the distribution of the 2,083 "wet days" which occurred in the 52 years, 1859-1910, the authors examined the number of instances in which an insurance under one or two of the forms of policy offered would have resulted in a claim had a person in London insured every day for the week commencing with that day during the whole period of 52 years. The actual compensation yielded by each £1 of premium during each 7-day period would have been as follows:—

Policy.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
A ...	8/8	6/5	6/10	4/1	4/9	11/3	10/7	11/1	10/1	18/10	15/9	11/1	10/-
B ...	9/1	8/6	7/10	7/7	9/1	11/3	11/4	10/10	10/-	13/10	12/8	10/9	10/3

Col. H. E. Rawson thought that no one would take out a policy in February. In the month of February they had their anticyclonic system arriving from Scandinavia, and bringing high pressure and no rain. The anticyclone belonging to Siberia moved westward in that month, and from 10 years' analyses of daily charts he had found that that particular system reached them as a mean on February 25th, when they had a coalescence of the Azores and Scandinavian systems.

Mr. F. J. Brodie thought that it would be almost impossible to discuss the question of rain insurance properly until they had received a large number of records from self-recording rain gauges which showed not only how much rain fell, but, more important still, when it fell, and how.

Mr. E. Gold took exception to the term "wet day," as used by Dr. Mill in the paper. He suggested that days with $\cdot 20$ in. of rain or more might be called "X" days, being days on which rainfall exceeded the limit fixed by the *Excess* Insurance Company.

Mr. R. H. Hooker, Mr. W. W. Bryant, Mr. R. Strachan and Mr. J. Hopkinson took part in the discussion.

Dr. Mill, in reply, said that he agreed generally with all the speakers, but he did not think there was any great harm in using the term "wet day" in a temporary way as a contraction for "day with more than $\cdot 20$ in. of rain falling in the 24 hours commencing at 9 a.m."

Mr. E. Mawley read his "Report on the Phenological Observations for 1910." The most noteworthy features of the Phenological year ending November, 1910, as affecting vegetation, were the continuous and heavy rainfall in February, a sudden change from cold to warm weather in the middle of May, the great dryness of September, and the heavy rains and low night temperatures in November. During the greater part of the year wild plants came into blossom behind their usual time, the departures from the average being greatest at the end of April and the beginning of May. Such early spring migrants as the swallow, cuckoo and nightingale made their appearance at about their usual dates. The only deficient farm crops were wheat, barley and peas. On the other hand, the yield of oats, beans, potatoes, turnips, mangolds and hay were above the average, and more especially beans, turnips and hay. The crop of apples, pears and plums was much under average, while all the small fruits, except strawberries which yielded well, were also rather under average.

As this was the last Report which Mr. Mawley would present on the Phenological Observations, an exceedingly cordial vote of thanks was accorded to him for having carried on the work during the past 20 years, and those present expressed their admiration of the way in which Mr. Mawley had devoted himself to this long labour of love.

The following gentlemen were elected Fellows of the Society:—Prof. S. C. Carrington, Mr. W. J. Carter, Capt. C. Eddie, Mr. K. S. A. Khan, Mr. S. D. Shroff, Mr. T. C. Soni, and Mr. A. F. Tredcroft, Assoc. M. Inst. C. E.

The biennial Dinner of the Society was held on Wednesday evening, May 17th, at the Trocadero Restaurant, Piccadilly Circus. The Fellows and their friends were received by the President (Dr. H. N. Dickson) before the Dinner.

The following is a list of those who were present (the names of the guests of the Society being printed in small capitals):—Mr. F. C. Bayard, Capt. A. E. Bell, Rev. H. A. Boys, Col. C. K. Brooke, Mr

A. H. Brown, Mr. W. W. Bryant, Commander W. F. Caborne, C.B., Mr. J. E. Clark, Mr. E. L. S. Cocks (Mayor of the City of Westminster), Mr. R. Corless, Mr. G. L. Courthope, M.P., Mr. J. A. Curtis, Mr. F. A. Darton, Mr. Du B. Davidson, Mr. F. Druce, Mr. F. W. Dyson, F.R.S. (Astronomer Royal), Mr. T. L. K. Edge, Mr. F. B. Edmonds, Mr. M. L. Evans, Mr. E. J. Garwood, Sir A. GEIKIE, K.C.B. (President of the Royal Society), Mr. E. Gold, Mr. P. H. Hepburn, Mr. N. Holden, Mr. T. F. Husband, Mr. R. Inwards, Mr. B. Latham, Mr. W. Marriott, Mr. W. J. Marriott, Mr. J. McEwan, Mr. T. McRow (Secretary of the Royal Agricultural Society), Mr. H. Mellish, Mr. G. H. Menhinnick, Dr. H. R. Mill (Director of the British Rainfall Organization), Mr. R. W. Munro, Mr. B. G. Pahlajaney, Prof. C. W. Peake, Mr. G. R. Pember, Major C. Peters, Dr. A. Philpot, Col. H. E. Rawson, C.B., Hon. K. Russell, Mr. S. C. Russell, Mr. C. Salter, Dr. R. H. Scott, F.R.S., Mr. W. Sedgwick, Dr. W. N. Shaw, F.R.S. (Director of the Meteorological Office), Mr. A. SIEMENS (President of the Institution of Civil Engineers), Capt. A. Simpson, Mr. J. A. G. Simpson, Mr. W. F. V. Simpson, Prof. H. J. Spooner, Mr. E. WHITE (Chairman of the London County Council), and the Rev. F. Wood.

After the usual loyal toasts had been proposed by the President, Dr. H. R. Mill proposed "The Houses of Parliament." Mr. G. L. Courthope, M.P., in responding, said that the Royal Meteorological Society and its work had benefitted agriculture in this country. He hoped that some one would make a study of the dry autumns in relation to sugar beet, and so confer a further benefit upon the agricultural community.

Sir Archibald Geikie in proposing "The Royal Meteorological Society," said that among the institutions in this country which have advanced the progress of meteorology, the Royal Meteorological Society deserves special recognition. Though only some 60 years old it has an excellent record of work done. Its numerous observing stations, its researches with kites and balloons, and its lectures for the purpose of making the principles and applications of the science more widely known, show a large amount of well-directed scientific energy.

The President, in responding, said that the interest which agricultural students take in the subject of meteorology had led him to re-examine some of the meteorological beliefs which one has usually taken for granted, and he thought that there were unlimited opportunities for the extension and opening up of new fields of work in this way.

Dr. W. N. Shaw proposed the toast of "Kindred Institutions," with which he coupled the name of Mr. Alexander Siemens, the President of the Institution of Civil Engineers, whose hospitality to the Society was highly appreciated by all present.

Mr. A. Siemens, in reply, said that the Society was always very welcome to the use of the rooms of the Institution, and he hoped that in about two years time they would be in the position to offer

the Society even better accommodation in their new building now in course of construction.

Mr. F. Druce, in proposing the toast of "Meteorology and Education," thought that it would not be too much to ask that every University throughout the country should have a lectureship of meteorology, and also that every medical and naval college should make this a subject of examination. If this were so, the great public schools would have to follow suit, and so the class in this country from which our greatest intellect is drawn would have a chance of acquiring some knowledge of this science.

Mr. T. McRow, in responding to the toast, said that the Royal Meteorological Society's exhibits at the Royal Agricultural Society's Shows were always very attractive, and were greatly appreciated.

Mr. H. Mellish proposed the toast of "the Visitors," to which Mr. E. L. S. Cocks, Mayor of the City of Westminster, responded.

Mr. E. White, the Chairman of the London County Council, proposed the toast of "the President," to which the Chairman briefly replied.

That the dinner was a successful one was shown by the fact that all present remained to the end, and kept their seats for some time after the conclusion of the speeches.

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**Correspondence.**

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

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## THE GREAT THUNDERSTORM OF MAY 31st, 1911.

I REMEMBER with considerable accuracy every thunderstorm that has occurred in the neighbourhood that I have happened to be in since the year 1890, when I was seven years old, and can fairly say that so far as London is concerned, the storm of the evening of May 31st was, in view of the terrific force of the discharges breaking every few seconds through an overwhelming darkness, the grandest and most awe-inspiring spectacle of the kind in my whole experience.

As usual the electrical disturbances seemed to burst independently at various points in and around London during the afternoon and evening, and one could not follow with certainty the career of any particular storm-centre. The fiercely hot and sultry May of 1911—in which, however, the usual polar snap managed to put in an appearance around the 20th—was prolific of thunderstorms of a truly terrific character in various parts of Great Britain, and the one which raged north of London on the afternoon of the 13th was just as severe as that of the 31st in the metropolis itself. The peculiar liability of the month of May to thunderstorms of a violent and dangerous type is well known at the Meteorological Office, and although July is usually credited with producing most thunder,

there is really very little to choose between May, June and July, the three months constituting the midsummer period. It would require a laborious statistical investigation to find out with certainty whether any small period in these three months is more thundery than another, but if I were asked for my impression as the result of personal and general experience as to the particular week in the year during which violent thunderstorms are especially liable to occur, I should point not to the fourth week in July, but to the week which marks the passing of May into June, say, May 28th—June 4th.

The physical explanation why all our most severe thunderstorms, like that of May 31st, occur in the narrow neck of relatively low barometric pressure between two anticyclonic systems is too obvious to need much demonstration.

The ascending currents of air necessary to thunderstorm generation cannot be established unless there is denser air available to supply the deficit of pressure to which the ascent of masses of air must necessarily give rise. Clearly the lateral pressure due to the outward downflow of air from the anticyclones will have the effect of forcing up masses of light heated air within the neck of low pressure.

L. C. W. BONACINA.

*3, Crossfield Road, South Hampstead, N. W., June 3rd, 1911.*

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THE severest thunderstorm, and heaviest rainfall since records commenced in 1903, occurred here between 5 and 8 p.m. on May 31st.

The day had been exceptionally humid and close with a dense thunder haze gathering up towards 3 p.m. Very distant thunder was heard away to the northward at 3.35 p.m., continuing at intervals to 4.46 p.m., when three distinct storm centres became apparent—one to N. and N.E., another to N.W., and a third to S. and S.W. Two separate cloud currents were visible at 5 p.m., an upper one from S.W., and a lower from N.E. Fork lightning was first seen at 4.59 p.m., when the time interval to thunder was 3 seconds, and from then until 7 p.m. lightning and thunder were practically continuous. Rolling thunder was entirely absent, the peals coming in sharp decisive cracks, closely resembling cannonading, whilst the lightning flashes were of dazzling intensity. Between 5.30 and 5.45 p.m. a count of flash-frequency yielded 159.

The N. and N.E. and S. and S.W. centres appeared to coalesce near the zenith at 5.35 p.m., remaining almost stationary till 6.45 p.m., when a movement in a W. direction set in. The N.W. centre did not develop.

Rain commenced at 5.20 p.m., falling in a continuous torrent to 6.10 p.m., during which time the roads were converted into running streams, being over two feet deep in places. During the 50 minutes the rainfall amounted to 2.44 inches; and on the gauge being again read at 8 p.m. a further fall of 0.42 in. was registered, making a total of 2.86 inches in 2 hours and 40 minutes. The last thunder

was heard at 7.59 p.m., sheet lightning remaining visible until 9.30 p.m. Within a radius of three miles the following damage by lightning was recorded :—

| Time.         | Persons.  |            |     | Horses<br>killed. |     | Property<br>damaged.    |     | Direction. |
|---------------|-----------|------------|-----|-------------------|-----|-------------------------|-----|------------|
| 5.30 p.m..... | Killed. 3 | Injured. 8 | ... | 1                 | ... | —                       | ... | E. & S.E.  |
| 6.5 p.m.....  | —         | —          | ... | —                 | ... | 3 ricks (hay)<br>fired. | ... | N.E.       |
| 6.25 p.m..... | —         | 6          | ... | 3                 | ... | —                       | ... | S.E.       |

SPENCER C. RUSSELL.

*Epsom, Surrey, June 3rd, 1911.*

### FLOOD RAINS IN BUENOS AIRES.

AFTER five years' drought the city and province of Buenos Aires have been visited within a month by three very severe rainstorms. The first of these occurred on April 12th, when the rainfall over the city limits varied between 2.87 and 6.42 inches; this was a local thunderstorm rain, and did not extend in an intense form into the Province. On April 23rd great rains fell immediately to the south and east of Buenos Aires, although in the capital itself the maximum fall was 3.78 inches. The maximum falls reported in the 24 hours were 10.11 inches at Las Heras and 9.76 inches at La Llala, the mean rainfall over an area of 5,000 square miles being 7.76 inches. Great floods took place, owing to the overflowing of the Rio Chuelo, which flows through a thickly populated suburb of Buenos Aires, thousands of people were rendered homeless, and many lives were lost. On May 13th the city and adjoining region experienced another rainstorm, the downfall ranging from 4.33 to 2.80 inches, while in the Province 28 stations reported more than 100 millimetres (3.94 inches), the maximum fall being 7.60 inches at San Fernandez. Severe flooding was also reported on May 11th in the Province of Neuquen, owing to the rise of the Rivers Neuquen and Limay, due to excessive precipitation associated with a deep depression which advanced from the Pacific.

R. C. MOSSMAN.

*Buenos Aires, May 16th, 1911.*

### REVIEW.

*Handbuch der Ozeanographie* von DR. OTTO KRÜMMEL. *Band II. Die Bewegungsformen des Meeres (Wellen, Gezeiten, Strömungen).* Mit 182 Abbildungen im Text. Zweite, vollständig neu bearbeitete und wesentlich erweiterte Auflage. [Handbook of Oceanography by Dr. Otto Krümmel. Vol. II. The Movements of the Sea—Waves, Tides, Currents. With 182 illustrations in the text. Second Edition, completely recast and much enlarged.] Stuttgart : J. Engelhorn's Successors. 1911. Size 9 × 6½. Pp. xvi. + 766. Price 32 marks.

Four years ago we had the pleasure of welcoming the first volume of

this important work (Vol. 42 (1907), p. 238), and we now have the satisfaction of receiving the completion of the standard treatise of Oceanography, a science in which Professor Krümmel has made himself as supreme a master as Professor Hann in Meteorology. As in the first volume the fullest recognition is given to all the author's fellow-workers, and this entails the very frequent citation of works in the English language, for although there is no English treatise on oceanography, the greater part of the data on which the science was founded have been placed on record by British and American authorities. In recent years, we must confess, a greater volume of research has been flowing through German, Scandinavian, and Monegasque channels, all of which are rendered tributary in this splendid compendium and generalization.

Of the three divisions of the present volume, that on Tides may be said to stand clear of Meteorology, while that on Waves only touches on the particular subject of this Magazine in so far as concerns the relation to wind. In this connection it is interesting to note that Professor Krümmel, while quoting from this Magazine (Vol. 36 (1901), p. 57) Dr. Vaughan Cornish's statement that great wind waves usually come in groups of three, with the highest in the middle, recalls the expression which the fishermen near Kiel apply familiarly to such waves, "the mother with the two daughters."

Most meteorological interest attaches to the section on Ocean Currents, which have such far-reaching effects in modifying the climates of the Earth's surface. This is the first time that the results of the modern apparatus for the measurement of currents have been put forward in a systematic and generalized form. Professor Krümmel points out that one set of theorists accounts for ocean currents by the rotation of the Earth, another by differences of density due to temperature and salinity, and a third by the influence of wind. He shows that there are many constituent causes of the movement and direction of ocean currents, no one of which can account for all the phenomena. The main causes are differences of density, produced in various ways in the water itself by evaporation, radiation, rainfall, ice-melting, &c., and by external agents such as wind and the differences in atmospheric pressure from place to place. Secondary causes which affect the direction rather than the formation of currents include friction, the deviating influence of the Earth's rotation, and the configuration of the ocean shores. Each of these causes is described at length with adequate illustrations and copious references to original papers. The theoretical bearings of the question being thus established, the section concludes with a concise summary of the actual system of oceanic currents in each of the oceans.

Works of the standing of this treatise do not often appear, and Professor Krümmel deserves hearty congratulations on his courage in undertaking so great a task and on the result which he has achieved.

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## BALLOON ASCENTS, SEPTEMBER—OCTOBER, 1908.

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

*September 30th, 1908.*

| Starting Point.  | Country      | A<br>miles. | B<br>° F. | C<br>miles. | D<br>° F. | E<br>miles. | F          |
|------------------|--------------|-------------|-----------|-------------|-----------|-------------|------------|
| Manchester....   | England .... | 9·2         | —78       | 9·4         | —76       | 59          | N.E. by N. |
| Petersfield .... | " .....      | 9·4         | —76       | 13·1        | —72       | 63          | N.E.       |
| Hamburg.....     | Germany....  | ?           | —85       | 8·4         | ?         | 37          | S.S.E.     |
| Lindenberg....   | " .....      | 8·4         | —101      | 8·6         | —99       | 39          | S. by W.   |
| Paris .....      | France ..... | 8·9         | —85       | 10·5        | —83       | 23          | N.E.       |
| Strassburg ....  | Germany....  | 8·8         | —90       | 11·9        | —67       | 32          | S.S.W.     |
| Munich.....      | " .....      | 8·4         | —90       | 9·4         | —80       | 58          | S.S.W.     |
| Vienna.....      | Austria .... | 7·9         | —83       | 10·9        | —65       | 150         | S.S.W.     |
| Pavia .....      | Italy .....  | 7·7         | —89       | 9·6         | —80       | 41          | S.W. by S. |
| Pavlovsk ....    | Russia ..... | —           | —         | 6·8         | —72       | 39          | S.S.E.     |

*October 1st, 1908.*

|                  |              |     |     |      |     |    |            |
|------------------|--------------|-----|-----|------|-----|----|------------|
| Pyrton Hill....  | England .... | 8·9 | —90 | 13·1 | —76 | 91 | N.N.E.     |
| Petersfield .... | " .....      | 8·8 | —78 | 11·3 | —72 | 88 | N.N.E.     |
| Brussels .....   | Belgium .... | —   | —   | 7·5  | —81 | 7  | E.         |
| Hamburg.....     | Germany....  | 9·6 | —87 | 14·0 | —69 | 3  | S.E.       |
| Paris .....      | France ..... | 7·8 | —89 | 9·6  | —78 | 22 | N. by W.   |
| Strassburg ....  | Germany....  | 9·5 | —85 | 10·0 | —81 | 32 | S.W.       |
| Munich .....     | " .....      | 8·6 | —81 | 8·8  | —81 | 40 | S.W. by W. |
| Vienna.....      | Austria....  | 8·2 | —90 | 10·0 | —81 | 75 | S.W.       |
| Pavia .....      | Italy .....  | 6·8 | —74 | ?    | —   | 65 | S.W. by S. |
| Kuchino .....    | Russia ..... | 7·2 | —63 | 9·7  | —61 | 52 | S.S.E.     |

*October 2nd, 1908.*

|                  |              |     |     |      |     |    |            |
|------------------|--------------|-----|-----|------|-----|----|------------|
| Manchester....   | England .... | —   | —   | 6·6  | —56 | 50 | N.N.E.     |
| Pyrton Hill....  | " .....      | 8·9 | —80 | 12·5 | —67 | 38 | N.E. by N. |
| Petersfield .... | " .....      | 8·9 | —78 | 10·0 | —74 | 36 | N. by E.   |
| Brussels .....   | Belgium .... | 8·1 | —83 | 8·3  | —83 | 9  | W.S.W.     |
| Hamburg.....     | Germany....  | —   | —81 | 8·7  | —   | 49 | S.E. by S. |
| Paris .....      | France ..... | 8·4 | —87 | 9·4  | —69 | 75 | N.W.       |
| Strassburg ....  | Germany....  | 8·4 | —91 | 8·8  | —87 | 15 | S.S.W.     |
| Munich .....     | " .....      | 8·3 | —85 | 9·0  | —85 | 40 | S.W. by W. |
| Vienna.....      | Austria .... | 8·5 | —90 | —    | —   | 62 | S.W.       |
| Pavia .....      | Italy .....  | 7·6 | —89 | 8·5  | —85 | 41 | W.S.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 figures are remarkable for the low temperatures, and more especially for the height of the commencement of the isothermal zone. The average values for October are 7·3 miles and —67° F., and it is unusual to find individual values above 8 miles or below —85°. The uniformity over the whole of West and Central Europe of very unusual conditions affords a strong proof of the general reliability of the observations. Settled fine weather prevailed during the period, and the temperature at the surface was unusually high for October. An extensive area of high pressure prevailed during the three days, and the drift of the balloons shows an anticyclonic circulation round the neighbourhood of Paris and Brussels.

## RAINFALL TABLE FOR MAY, 1911.

| STATION.                         | COUNTY.                   | Lat.<br>N. | Long.<br>W.<br>[*E.] | Height<br>above<br>Sea.<br>ft. | RAINFALL<br>OF MONTH.          |              |
|----------------------------------|---------------------------|------------|----------------------|--------------------------------|--------------------------------|--------------|
|                                  |                           |            |                      |                                | Aver.<br>1875—<br>1909.<br>in. | 1911.<br>in. |
| Camden Square.....               | <i>London</i> .....       | 51 32      | 0 8                  | 111                            | 1'75                           | 1'80         |
| Tenterden.....                   | <i>Kent</i> .....         | 51 4       | *0 41                | 190                            | 1'65                           | '75          |
| Arundel (Patching).....          | <i>Sussex</i> .....       | 50 51      | 0 27                 | 130                            | 1'80                           | 1'13         |
| Southampton (Cadland) ...        | <i>Hampshire</i> .....    | 50 50      | 1 22                 | 52                             | 1'96                           | 1'71         |
| Oxford (Magdalen College)...     | <i>Oxfordshire</i> .....  | 51 45      | 1 15                 | 186                            | 1'81                           | 2'21         |
| Wellingborough (Croyland Abbey). | <i>Northampton</i> ....   | 52 18      | 0 41                 | 174                            | 1'99                           | 2'59         |
| Shoeburyness.....                | <i>Essex</i> .....        | 51 31      | *0 48                | 13                             | 1'27                           | '83          |
| Bury St. Edmunds (Westley)       | <i>Suffolk</i> .....      | 52 15      | *0 40                | 226                            | 1'93                           | '82          |
| Geldeston [Beccles].....         | <i>Norfolk</i> .....      | 52 27      | *1 31                | 38                             | 1'78                           | '75          |
| Polapit Tamar [Launceston]       | <i>Devon</i> .....        | 50 40      | 4 22                 | 315                            | 2'08                           | '86          |
| Rousdon [Lyme Regis].....        | ".....                    | 50 41      | 3 0                  | 516                            | 2'02                           | '61          |
| Stroud (Uplfield).....           | <i>Gloucestershire</i> .. | 51 44      | 2 13                 | 226                            | 2'10                           | 1'19         |
| Church Stretton (Wolstaston)..   | <i>Shropshire</i> .....   | 52 35      | 2 48                 | 800                            | 2'64                           | 1'20         |
| Coventry (Kingswood).....        | <i>Warwickshire</i> ...   | 52 24      | 1 30                 | 340                            | 2'15                           | '84          |
| Boston.....                      | <i>Lincolnshire</i> ....  | 52 58      | 0 1                  | 25                             | 1'80                           | '73          |
| Worksop (Hodsock Priory).        | <i>Nottinghamshire</i>    | 53 22      | 1 5                  | 56                             | 2'08                           | '83          |
| Macclesfield.....                | <i>Cheshire</i> .....     | 53 15      | 2 7                  | 501                            | 2'43                           | '71          |
| Southport (Hesketh Park)..       | <i>Lancashire</i> .....   | 53 38      | 2 59                 | 38                             | 2'13                           | 1'48         |
| Wetherby (Ribston Hall) ...      | <i>Yorkshire, W.R.</i>    | 53 59      | 1 24                 | 130                            | 2'09                           | 1'18         |
| Arneliffe Vicarage.....          | ".....                    | 54 8       | 2 6                  | 732                            | 3'55                           | 3'90         |
| Hull (Pearson Park).....         | <i>E.R.</i> .....         | 53 45      | 0 20                 | 6                              | 1'98                           | '48          |
| Newcastle (Town Moor) ...        | <i>Northumberland</i>     | 54 59      | 1 38                 | 201                            | 2'04                           | '64          |
| Borrowdale (Seathwaite) ...      | <i>Cumberland</i> ....    | 54 30      | 3 10                 | 423                            | 7'50                           | 8'66         |
| Cardiff (Ely).....               | <i>Glamorgan</i> .....    | 51 29      | 3 13                 | 53                             | 2'56                           | 1'50         |
| Haverfordwest.....               | <i>Pembroke</i> .....     | 51 48      | 4 58                 | 95                             | 2'62                           | 1'79         |
| Aberystwyth (Gogerddan)..        | <i>Cardigan</i> .....     | 52 26      | 4 1                  | 83                             | 2'63                           | 2'94         |
| Llandudno.....                   | <i>Carnarvon</i> .....    | 53 20      | 3 50                 | 72                             | 1'86                           | 1'70         |
| Cargen [Dumfries].....           | <i>Kirkcudbright</i> ...  | 55 2       | 3 37                 | 80                             | 2'87                           | 4'16         |
| Marchmont House.....             | <i>Berwick</i> .....      | 55 44      | 2 24                 | 498                            | 2'53                           | '86          |
| Girvan (Pinnmore).....           | <i>Ayr</i> .....          | 55 10      | 4 49                 | 207                            | 2'98                           | 2'62         |
| Glasgow (Queen's Park) ...       | <i>Renfrew</i> .....      | 55 53      | 4 18                 | 144                            | 2'40                           | 2'24         |
| Inveraray (Newtown).....         | <i>Argyll</i> .....       | 56 14      | 5 4                  | 17                             | 3'53                           | 4'96         |
| Mull (Quinish).....              | ".....                    | 56 34      | 6 13                 | 35                             | 2'99                           | 4'39         |
| Dundee (Eastern Necropolis)      | <i>Forfar</i> .....       | 56 28      | 2 57                 | 199                            | 2'05                           | '81          |
| Braemar.....                     | <i>Aberdeen</i> .....     | 57 0       | 3 24                 | 1114                           | 2'33                           | 1'70         |
| Aberdeen (Cranford).....         | ".....                    | 57 8       | 2 7                  | 120                            | 2'40                           | 2'56         |
| Cawdor.....                      | <i>Nairn</i> .....        | 57 31      | 3 57                 | 250                            | 2'07                           | 2'20         |
| Fort Augustus (S. Benedict's)    | <i>E. Inverness</i> ...   | 57 9       | 4 41                 | 68                             | 2'36                           | 1'94         |
| Loch Torridon (Bendamph)         | <i>W. Ross</i> .....      | 57 32      | 5 32                 | 20                             | 4'54                           | 4'92         |
| Dunrobin Castle.....             | <i>Sutherland</i> .....   | 57 59      | 3 56                 | 14                             | 2'19                           | 2'29         |
| Wick.....                        | <i>Caithness</i> .....    | 58 26      | 3 6                  | 77                             | 2'04                           | 2'02         |
| Killarney (District Asylum)      | <i>Kerry</i> .....        | 52 4       | 9 31                 | 178                            | 3'05                           | 5'48         |
| Waterford (Brook Lodge)...       | <i>Waterford</i> .....    | 52 15      | 7 7                  | 104                            | 2'33                           | 1'34         |
| Nenagh (Castle Lough).....       | <i>Tipperary</i> .....    | 52 54      | 8 24                 | 120                            | 2'51                           | 2'99         |
| Miltown Malbay.....              | <i>Clare</i> .....        | 52 52      | 9 26                 | 400                            | 2'57                           | 3'10         |
| Gorey (Courtown House) ...       | <i>Wexford</i> .....      | 52 40      | 6 13                 | 80                             | 2'24                           | 1'37         |
| Abbey Leix (Blandsfort)....      | <i>Queen's County</i> ..  | 52 56      | 7 17                 | 532                            | 2'43                           | 1'97         |
| Dublin (Fitz William Square)     | <i>Dublin</i> .....       | 53 21      | 6 14                 | 54                             | 2'07                           | 1'29         |
| Mullingar (Belvedere).....       | <i>Westmeath</i> .....    | 53 29      | 7 22                 | 367                            | 2'51                           | 2'39         |
| Ballinasloe.....                 | <i>Galway</i> .....       | 53 20      | 8 15                 | 160                            | 2'58                           | 2'56         |
| Crossmolina (Enniscoe).....      | <i>Mayo</i> .....         | 54 4       | 9 18                 | 74                             | 3'17                           | 2'26         |
| Collooney (Markree Obsy.).       | <i>Sligo</i> .....        | 54 11      | 8 27                 | 127                            | 2'80                           | 1'75         |
| Seaforde.....                    | <i>Down</i> .....         | 54 19      | 5 50                 | 180                            | 2'72                           | 2'01         |
| Bushmills (Dundarave).....       | <i>Antrim</i> .....       | 55 12      | 6 30                 | 162                            | 2'37                           | 1'91         |
| Omagh (Edenfel).....             | <i>Tyrone</i> .....       | 54 36      | 7 18                 | 280                            | 2'66                           | 1'72         |

## RAINFALL TABLE FOR MAY, 1911—continued.

| RAINFALL OF MONTH (con.) |          |                   |             |     | RAINFALL FROM JAN. 1. |       |                      |          | Mean Annual 1875-1909. | STATION.        |
|--------------------------|----------|-------------------|-------------|-----|-----------------------|-------|----------------------|----------|------------------------|-----------------|
| Diff. from Av. in.       | % of Av. | Max. in 24 hours. | No. of Days |     | Aver. 1875-1909.      | 1911. | Diff. from Aver. in. | % of Av. |                        |                 |
|                          |          | in.               | Date.       |     | in.                   | in.   |                      |          | in.                    |                 |
| + .05                    | 103      | .50               | 31          | 10  | 8.68                  | 8.19  | — .49                | 94       | 25.11                  | Camden Square   |
| — .90                    | 45       | .34               | 13          | 6   | 9.41                  | 7.78  | —1.63                | 83       | 27.64                  | Tenterden       |
| — .67                    | 63       | .33               | 2           | 7   | 10.33                 | 8.16  | —2.17                | 79       | 30.48                  | Patching        |
| — .25                    | 87       | .40               | 25          | 8   | 11.14                 | 8.34  | —2.80                | 75       | 31.87                  | Cadland         |
| + .40                    | 122      | .84               | 25          | 8   | 8.33                  | 6.79  | —1.54                | 81       | 24.58                  | Oxford          |
| + .60                    | 130      | 1.09              | 25          | 8   | 9.04                  | 7.06  | —1.98                | 78       | 25.17                  | Croyland Abbey  |
| — .44                    | 65       | .33               | 14          | 5   | 6.23                  | 5.21  | —1.02                | 84       | 19.28                  | Shoeburyness    |
| —1.11                    | 42       | .42               | 14          | 6   | 8.55                  | 7.19  | —1.36                | 84       | 25.40                  | Westley         |
| —1.03                    | 42       | .38               | 14          | 6   | 7.84                  | 6.83  | —1.01                | 87       | 23.73                  | Goldeston       |
| —1.22                    | 41       | .34               | 3           | 7   | 13.70                 | 9.45  | —4.25                | 69       | 38.27                  | Polapit Tamar   |
| —1.41                    | 30       | .37               | 2           | 5   | 12.15                 | 8.25  | —3.90                | 68       | 33.54                  | Rousdon         |
| — .91                    | 57       | .35               | 11          | 9   | 10.65                 | 7.14  | —3.51                | 67       | 29.81                  | Stroud          |
| —1.44                    | 45       | .45               | 3           | 9   | 11.71                 | 7.85  | —3.86                | 67       | 32.41                  | Wolstaston      |
| —1.31                    | 39       | .51               | 25          | 4   | 10.23                 | 5.83  | —4.40                | 57       | 28.98                  | Coventry        |
| —1.07                    | 41       | .37               | 14          | 8   | 7.91                  | 5.89  | —2.02                | 74       | 23.35                  | Boston          |
| —1.25                    | 40       | .38               | 26          | 8   | 8.74                  | 4.26  | —4.48                | 49       | 24.46                  | Hodsock Priory  |
| —1.72                    | 29       | .36               | 3           | 9   | 11.91                 | 9.55  | —2.36                | 80       | 34.73                  | Macclesfield    |
| — .65                    | 69       | .80               | 3           | 6   | 10.70                 | 8.83  | —1.87                | 83       | 32.70                  | Southport       |
| — .91                    | 56       | .30               | 14          | 7   | 9.46                  | 6.91  | —2.55                | 73       | 26.87                  | Ribston Hall    |
| + .35                    | 110      | 1.28              | 3           | 13  | 23.59                 | 29.66 | +6.07                | 126      | 61.49                  | Arncliffe       |
| —1.50                    | 24       | .18               | 30          | 8   | 8.99                  | 6.74  | —2.25                | 75       | 26.42                  | Hull            |
| —1.40                    | 31       | .20               | 14          | 11  | 9.51                  | 6.88  | —2.63                | 72       | 27.94                  | Newcastle       |
| +1.16                    | 115      | 2.57              | 3           | 12  | 49.44                 | 59.20 | +9.76                | 120      | 129.48                 | Seathwaite      |
| —1.06                    | 59       | .63               | 3           | 8   | 14.67                 | 13.41 | —1.26                | 91       | 42.28                  | Cardiff         |
| — .83                    | 68       | .78               | 3           | 8   | 16.71                 | 14.47 | —2.24                | 87       | 46.81                  | Haverfordwest   |
| + .31                    | 112      | 1.58              | 13          | 11  | 15.15                 | 13.87 | —1.28                | 92       | 45.46                  | Gogerddan       |
| — .16                    | 91       | .71               | 13          | 7   | 10.40                 | 7.55  | —2.85                | 73       | 30.36                  | Llandudno       |
| +1.29                    | 145      | 1.32              | 3           | 11  | 16.22                 | 17.58 | +1.36                | 108      | 43.47                  | Cargen          |
| —1.67                    | 34       | .33               | 3           | 8   | 12.00                 | 8.43  | —3.57                | 70       | 33.76                  | Marchmont       |
| — .36                    | 88       | .52               | 2           | 16  | 18.06                 | 18.31 | + .25                | 101      | 49.77                  | Girvan          |
| — .16                    | 93       | .67               | 3           | 12  | 13.10                 | 15.03 | +1.93                | 115      | 35.97                  | Glasgow         |
| +1.43                    | 140      | 1.13              | 1           | 13  | 25.68                 | 35.00 | +9.32                | 136      | 68.67                  | Inveraray       |
| +1.40                    | 147      | .97               | 1           | 14  | 20.25                 | 22.94 | +2.69                | 113      | 56.57                  | Quinish         |
| —1.24                    | 40       | .31               | 3           | 9   | 9.96                  | 4.45  | —5.51                | 45       | 28.64                  | Dundee          |
| — .63                    | 73       | ...               | ...         | ... | 12.97                 | 11.34 | —1.63                | 87       | 34.93                  | Braemar         |
| + .16                    | 107      | .66               | 15          | 12  | 12.00                 | 8.59  | —3.41                | 72       | 32.73                  | Aberdeen        |
| + .13                    | 106      | .84               | 13          | 9   | 10.38                 | 9.47  | — .91                | 91       | 29.33                  | Cawdor          |
| — .42                    | 82       | .45               | 3           | 14  | 18.15                 | 17.91 | — .24                | 99       | 44.53                  | Fort Augustus   |
| + .38                    | 108      | .86               | 23          | 14  | 33.32                 | 39.23 | +5.91                | 118      | 83.61                  | Bendamp         |
| + .10                    | 105      | .57               | 15          | 13  | 12.18                 | 11.81 | — .37                | 97       | 31.90                  | Dunrobin Castle |
| — .02                    | 99       | .40               | 15          | 17  | 10.88                 | 10.19 | — .69                | 94       | 29.88                  | Wick            |
| +2.43                    | 179      | 1.36              | 14          | 18  | 21.95                 | 17.56 | —4.39                | 80       | 54.81                  | Killarney       |
| — .99                    | 58       | .52               | 1           | 6   | 14.61                 | 10.51 | —4.10                | 72       | 39.57                  | Waterford       |
| + .48                    | 119      | 1.08              | 2           | 13  | 14.81                 | 12.21 | —2.60                | 82       | 39.43                  | Castle Lough    |
| + .53                    | 121      | .94               | 2           | 15  | 15.59                 | 13.24 | —2.35                | 85       | 45.11                  | Miltown Malbay  |
| — .87                    | 61       | .62               | 2           | 6   | 12.83                 | 8.24  | —4.59                | 64       | 34.99                  | Courtown Ho.    |
| — .46                    | 81       | .47               | 3           | 13  | 13.26                 | 11.49 | —1.77                | 87       | 35.92                  | Abbey Leix      |
| — .78                    | 62       | .49               | 13          | 10  | 10.15                 | 5.99  | —4.16                | 59       | 27.68                  | Dublin          |
| — .12                    | 95       | .54               | 3           | 12  | 13.29                 | 12.41 | — .88                | 93       | 36.15                  | Mullingar       |
| — .02                    | 99       | .93               | 2           | 13  | 13.46                 | 12.66 | — .80                | 94       | 36.64                  | Ballinasloe     |
| — .91                    | 71       | 1.07              | 2           | 11  | 20.21                 | 15.89 | —4.32                | 79       | 52.87                  | Enniscoe        |
| —1.05                    | 63       | .51               | 2           | 10  | 15.72                 | 13.16 | —2.56                | 84       | 42.71                  | Markree         |
| — .71                    | 74       | .99               | 13          | 10  | 14.54                 | 10.97 | —3.57                | 75       | 38.91                  | Seaforde        |
| — .46                    | 81       | .74               | 3           | 11  | 12.93                 | 10.44 | —2.49                | 81       | 37.56                  | Dundarave       |
| — .94                    | 65       | .35               | 2           | 13  | 14.28                 | 12.88 | —1.40                | 90       | 39.38                  | Omagh           |

## SUPPLEMENTARY RAINFALL, MAY, 1911.

| Div.  | STATION.                     | Rain<br>inches | Div.   | STATION.                     | Rain.<br>inches |
|-------|------------------------------|----------------|--------|------------------------------|-----------------|
| II.   | Warlingham, Redvers Road     | 1·77           | XI.    | Lligwy .....                 | 1·13            |
| „     | Ramsgate .....               | 1·11           | „      | Douglas .....                | 1·51            |
| „     | Hailsham .....               | ·81            | XII.   | Stoneykirk, Ardwell House    | 1·92            |
| „     | Totland Bay, Aston House.    | 1·18           | „      | Dalry, The Old Garroch ...   | 3·45            |
| „     | Stockbridge, Ashley .....    | 1·95           | „      | Langholm, Drove Road.....    | 3·56            |
| „     | Grayshott .....              | 1·71           | „      | Beattock, Kinnelhead.....    | 4·08            |
| „     | Reading, Calcot Place.....   | 2·12           | XIII.  | St Mary's Loch, Cramilt Ldge | 3·11            |
| III.  | Harrow Weald, Hill House.    | 1·85           | „      | North Berwick Reservoir ...  | ·84             |
| „     | Pitsford, Sedgebrook .....   | 2·54           | „      | Edinburgh, Royal Observty.   | 1·08            |
| „     | Somersham Vicarage.....      | ·65            | XIV.   | Maybole, Knockdon Farm..     | 2·67            |
| „     | Woburn, Milton Bryant.....   | 1·43           | XV.    | Campbeltown, Witchburn...    | 2·90            |
| IV.   | Colchester, Lexden.....      | ·74            | „      | Glenreadell Mains.....       | 3·41            |
| „     | Newport .....                | 2·41           | „      | Holy Loch, Ardnadam.....     | 6·02            |
| „     | Rendlesham .....             | ·47            | „      | Ballachulish House.....      | 5·87            |
| „     | Swaffham .....               | 1·44           | „      | Islay, Eallabus .....        | 3·41            |
| „     | Blakeney .....               | ·79            | XVI.   | Dollar Academy .....         | 1·33            |
| V.    | Bishops Cannings .....       | ·85            | „      | Balquhiddy, Stronvar .....   | 5·53            |
| „     | Winterbourne Steepleton ..   | 1·75           | „      | Coupar Angus .....           | 1·44            |
| „     | Ashburton, Druid House ..    | 1·75           | „      | Glenlyon, Meggernie Castle.  | 3·05            |
| „     | Okehampton, Oaklands.....    | 1·58           | „      | Blair Atholl .....           | 1·30            |
| „     | Cullompton .....             | 1·72           | „      | Montrose, Sunnyside Asylum   | ·67             |
| „     | Hartland Abbey .....         | ·87            | XVII.  | Alford, Lynturk Manse ...    | 1·54            |
| „     | Lynmouth, Rock House ...     | 2·50           | „      | Fyvie Castle.....            | 3·27            |
| „     | Probus, Lamellyn .....       | ·53            | „      | Keith Station .....          | 2·52            |
| „     | North Cadbury Rectory ..     | ·97            | XVIII. | Glenquoich, Loan .....       | 10·70           |
| VI.   | Clifton, Pembroke Road ...   | 1·21           | „      | Skye, Dunvegan .....         | 4·46            |
| „     | Ross, The Graig .....        | 2·11           | „      | N. Uist, Lochmaddy .....     | 3·38            |
| „     | Shifnal, Hatton Grange.....  | ·49            | „      | Alvey Manse .....            | ·80             |
| „     | Blockley, Upton Wold .....   | ·98            | „      | Loch Ness, Drumnadrochit.    | 1·19            |
| „     | Droitwich .....              | ·48            | „      | Glen carron Lodge .....      | 3·93            |
| VII.  | Market Overton.....          | 2·33           | XIX.   | Invershin .....              | 2·09            |
| „     | Market Rasen .....           | ·89            | „      | Loch Stack, Ardchullin.....  | 2·64            |
| „     | Bawtry, Hesley Hall.....     | ·76            | „      | Melvich.....                 | 1·53            |
| „     | Derby, Midland Railway ...   | ·73            | XX.    | Skibbereen Rectory.....      | 2·72            |
| „     | Buxton .....                 | 1·37           | „      | Dunmanway, The Rectory..     | 5·34            |
| VIII. | Nantwich, Dorfold Hall.....  | ·78            | „      | Cork .....                   | 1·82            |
| „     | Chatburn, Middlewood .....   | 2·01           | „      | Mitchelstown Castle .....    | 2·27            |
| „     | Cartmel, Flookburgh .....    | 1·67           | „      | Darrynane Abbey .....        | 2·72            |
| IX.   | Langsett Moor, Up. Midhope   | 9·7            | „      | Glenam [Clonmel] .....       | 1·30            |
| „     | Scarborough, Scalby .....    | ·94            | „      | Newmarket-on-Fergus, Fenloe  | 2·48            |
| „     | Ingleby Greenhow .....       | ·96            | XXI.   | Laragh, Glendalough .....    | 2·82            |
| „     | Mickleton .....              | 1·23           | „      | Balbriggan, Ardgillan.....   | 1·11            |
| X.    | Bellingham, High Green Manor | 1·72           | „      | Moynalty, Westland .....     | 1·97            |
| „     | Ilderton, Lilburn Cottage..  | ·67            | XXII.  | Cong, The Glebe .....        | 1·54            |
| „     | Keswick, The Bank .....      | 4·79           | „      | Westport, St. Helens .....   | 2·12            |
| XI.   | Llanfrechfa Grange.....      | 2·11           | „      | Achill Island, Dugort .....  | 3·89            |
| „     | Treherbert, Tyn-y-waun ...   | 5·92           | „      | Mohill .....                 | 2·44            |
| „     | Carmarthen, The Friary.....  | 3·04           | XXIII. | Enniskillen, Portora .....   | 1·50            |
| „     | Castle Malgwyn [Llechryd].   | 2·73           | „      | Dartrey [Cootehill].....     | 2·46            |
| „     | Plynlimon .....              | 2·90           | „      | Warrenpoint, Manor House     | 2·54            |
| „     | New Radnor, Ednol .....      | 1·38           | „      | Banbridge, Milltown .....    | 1·85            |
| „     | Rhayader, Tyrmynydd .....    | 1·68           | „      | Belfast, Cave Hill Road..... | 2·54            |
| „     | Lake Vyrnwy .....            | 1·86           | „      | Glenarm Castle.....          | 2·51            |
| „     | Llangyhanfal, Plâs Draw....  | 1·04           | „      | Londonderry, Creggan. Res.   | 1·78            |
| „     | Dolgelly, Bryntirion .....   | 2·30           | „      | Killybegs .....              | 2·15            |
| „     | Bettws-y-Coed, Tyn-y-bryn    | 2·36           | „      | Horn Head ... ..             | 1·04            |

## METEOROLOGICAL NOTES ON MAY, 1911.

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; F for number of days Frost in Screen; f on Grass.

LONDON, CAMDEN SQUARE.—Beautiful sunny weather with high temp. prevailed throughout. There were TSS on the 11th and 31st, which, together, yielded 50 per cent. of the total R for the month. During the latter storm, 25 in. of R fell in 6 minutes. The mean temp., 58°·0, was 40°·1 above the average and the highest in May since 1893, and excepting only that year and 1868, the highest in the 54 years' record. Duration of sunshine 180·1\* hours, and of R 22·8 hours. Evaporation 2·58 in. Shade max. 81°·7 on 31st; min. 38°·1 on 7th. F 0, f 0.

TENTERDEN.—A beautiful month and very warm, except in first week, and a few days in third. The latter half was very dry. Duration of sunshine 261·0† hours. Shade max. 78°·0 on 31st; min. 37°·0 on 7th. F 0, f 5.

TOTLAND BAY.—Duration of sunshine 267·3\* hours. Shade max. 75°·9 on 26th and 29th; min. 39°·8 on 5th. F 0, f 0.

PITSFORD.—R 49 in. above the average. Mean temp. 55°·8. Shade max. 76°·3 on 31st; min. 35°·2 on 9th. F 0.

NORTH CADBURY.—The calmest, and, on the whole, the warmest May in 15 years record. The conditions were of a thundery type for about half the month, and there was a bad storm on 10th, and slight storms on 26th and 30th. On 26th about 75 in. of R fell in a short time at Castle Cary, 3½ miles north. The streets were flooded and drains choked. Shade max. 81°·5 on 26th; min. 37°·0 on 3rd and 5th. F 0, f 8.

ROSS.—With the exception of heavy TSS on 10th and 26th, an exceptionally warm and fine month. Shade max. 78°·4 on 29th; min. 38°·1 on 21st. F 0, f 0.

HODSOCK PRIORY.—The R in the 5 months, January to May, is less than in any of the previous 35 years. Shade max. 75°·1 on 29th; min. 30°·9 on 9th. F 1, f 5.

SOUTHPORT.—The warmest May in 40 years record. Mean temp. 55°·3, or 4°·8 above the average. Duration of sunshine 247·5\* hours, and of R 19·9 hours. Shade max. 78°·4 on 29th; min. 37°·3 on 21st. F 0, f 5.

HULL.—Shade max. 77°·0 on 25th; min. 31°·0 on 1st. F 1, f 3.

NEWCASTLE.—The R was the least registered in May since 1868, with the exception of May, 1905, when 51 in. fell on 14 days.

HAVERFORDWEST.—Sunshine 267·3\* hours. Shade max. 78°·8 on 28th.

LLANDUDNO.—Duration of sunshine 257·6\* hours. Shade max. 69°·2 on 30th; min. 41°·8 on 21st.

CARGEN.—The shade max. exceeded 70° on the last six days and reached 79°·5 on 29th and 30th, which was unprecedented here in May. Shade min. 32°·5 on 1st and 6th. F 0.

EDINBURGH.—Shade max. 66°·8 on 28th; min. 36°·8 on 1st. F 0, f 1.

COUPAR ANGUS.—Mean temp. 54°·1 and 5° above the average. The shade max. exceeded 70° on every day in the last week and reached 78°·0 on 30th; min. 31°·5 on 5th.

FORT AUGUSTUS.—Shade max. 69°·0 on 25th; min. 29°·2 on 1st. F 1.

DUNMANWAY.—The first half was very unsettled, but the latter half was summerlike and warm, excepting the 23rd to 25th. T and L occurred on five days, and 75 in. of R fell in 40 minutes on 13th, and 70 in. in the same time on the 14th.

DUBLIN.—Though opening with unsettled weather the month proved to be one of the finest and warmest Mays on record. The mean temp., 55°·3, was only twice exceeded in the past 45 years, viz., in 1868 and 1893. Shade max. 69°·8 on 24th; min. 41°·1 on 4th. F 0, f 0.

MARKREE.—Shade max. 76°·0 on 29th; min. 34°·3 on 21st and 28th. F 0, f 13.

WARRENPOINT.—On the evening of 13th 1·03 in. of R fell in less than 45 minutes. Shade max. 72°·0 on 29th; min. 53°·0 on 3rd. F 0, f 0.

\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, December, 1910.

| STATIONS<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |       |               |           | Absolute.       |                   | Total Rain |                | Aver. |     |
|-----------------------------------------------------------------|-----------|-------|----------|-------|----------|-------|---------------|-----------|-----------------|-------------------|------------|----------------|-------|-----|
|                                                                 | Maximum.  |       | Minimum. |       | Max.     | Min.  | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.     | Days.          |       |     |
|                                                                 | Temp.     | Date. | Temp.    | Date. |          |       |               |           |                 |                   |            |                |       |     |
| London, Camden Square                                           | 54·6      | 16    | 26·8     | 28    | 48·7     | 40·0  | 41·9          | 0·100     | 91              | 67·0              | 21·8       | inches<br>3·29 | 20    | 8·0 |
| Malta ... ..                                                    | 71·2      | 7     | 47·3     | 30    | 62·9     | 55·4  | 54·0          | 84        | 134·1           | ...               | 6·52       | 15             | 6·1   |     |
| Lagos ... ..                                                    | 90·0      | 6     | 70·0     | 26    | 87·4     | 74·4  | 74·5          | 75        | 148·0           | 71·0              | ·14        | 2              | ...   |     |
| Cape Town ... ..                                                | 95·9      | 1     | 49·7     | 30    | 78·8     | 60·9  | 57·8          | 68        | ...             | ...               | ·07        | 3              | 2·3   |     |
| Durban, Natal ... ..                                            | ...       | ...   | ...      | ...   | ...      | ...   | ...           | ...       | ...             | ...               | ...        | ...            | ...   |     |
| Johannesburg ... ..                                             | 93·3      | 18    | 45·5     | 23    | 74·6     | 52·1  | 52·9          | 70        | 149·3           | 44·2              | 5·10       | 16             | 2·6   |     |
| Mauritius ... ..                                                | 88·5      | 27*   | 67·3     | 2     | 85·8     | 71·4  | 68·0          | 73        | 158·7           | 59·9              | 2·73       | 18             | 6·7   |     |
| Calcutta ... ..                                                 | 81·4      | 11    | 45·6     | 24    | 77·7     | 53·3  | 52·6          | 66        | ...             | 40·1              | ·00        | 0              | 0·4   |     |
| Bombay ... ..                                                   | 88·3      | 13    | 65·3     | 20    | 84·1     | 69·0  | 65·4          | 71        | 133·3           | 58·1              | ·00        | 0              | 0·3   |     |
| Madras ... ..                                                   | 85·5      | 24    | 62·2     | 18    | 83·7     | 67·0  | 65·1          | 76        | 135·5           | 58·8              | ·05        | 1              | 3·4   |     |
| Kodaikanal ... ..                                               | ...       | ...   | ...      | ...   | ...      | ...   | ...           | ...       | ...             | ...               | ...        | ...            | ...   |     |
| Colombo, Ceylon ... ..                                          | 88·2      | 29    | 69·6     | 16    | 85·1     | 71·4  | 69·7          | 77        | 137·0           | 65·2              | 3·37       | 8              | 4·7   |     |
| Hongkong ... ..                                                 | 77·1      | 1     | 45·8     | 23    | 65·1     | 54·9  | 49·0          | 66        | 120·2           | ...               | ·79        | 7              | 5·8   |     |
| Melbourne ... ..                                                | 94·9      | 29    | 43·2     | 21    | 73·3     | 52·5  | 48·4          | 60        | 158·9           | 38·9              | 3·64       | 16             | 6·0   |     |
| Adelaide ... ..                                                 | 96·0      | 26    | 45·5     | 19    | 76·8     | 55·0  | 48·7          | 55        | 166·8           | 38·5              | 1·25       | 8              | 5·0   |     |
| Coolgardie ... ..                                               | 100·6     | 24    | 46·0     | 2     | 88·9     | 58·0  | 47·8          | 46        | 163·8           | 42·9              | ·19        | 2              | 2·4   |     |
| Perth ... ..                                                    | 95·3      | 10    | 48·0     | 2     | 78·4     | 59·5  | 54·0          | 62        | 152·2           | 39·1              | ·09        | 2              | 2·8   |     |
| Sydney ... ..                                                   | 96·7      | 27    | 54·0     | 19    | 77·9     | 62·4  | 54·9          | 58        | 158·1           | 44·7              | 8·47       | 19             | 5·1   |     |
| Wellington ... ..                                               | 72·8      | 20    | 44·6     | 4     | 66·3     | 54·9  | 52·9          | 76        | 125·0           | 37·0              | 3·59       | 15             | 7·0   |     |
| Auckland ... ..                                                 | 76·5      | 16    | 52·0     | 11    | 69·9     | 57·5  | 58·0          | 83        | 143·0           | 48·0              | 2·83       | 19             | 6·0   |     |
| Jamaica, Kingston ... ..                                        | 88·9      | ...   | 63·9     | ...   | 85·5     | 69·1  | 68·5          | 79        | ...             | ...               | 3·09       | 10             | ...   |     |
| Grenada ... ..                                                  | 85·0      | 15†   | 70·0     | 26‡   | 82·7     | 73·8  | 69·8          | 77        | 141·0           | ...               | 5·74       | 24             | 3·5   |     |
| Toronto ... ..                                                  | 38·7      | 23    | —6·8     | 31    | 28·5     | 13·7  | ...           | 86        | 52·2            | —9·3              | 1·74       | 16             | 7·5   |     |
| Fredericton ... ..                                              | 46·5      | 24†   | —15·0    | 18    | 27·1     | 9·3   | ...           | 87        | ...             | ...               | 4·08       | 10             | 6·5   |     |
| St. John, N.B. ... ..                                           | 47·7      | 30    | —2·7     | 16    | 30·3     | 16·3  | ...           | ...       | ...             | ...               | 4·46       | 15             | 6·3   |     |
| Victoria, B.C. ... ..                                           | 51·5      | ...   | 30·3     | ...   | 45·7     | 39·9  | ...           | 91        | ...             | ...               | 6·41       | 21             | ...   |     |
| Dawson ... ..                                                   | 28·0      | 20    | —49·0    | 13    | —10·7    | —24·5 | ...           | ...       | ...             | ...               | ·60        | 12             | 7·1   |     |

\* and 30. † and 25. ‡ 27, 28 and 29.

MALTA.—Mean temp. of air 58°·6. Average bright sunshine 4·0 hours per day.

Johannesburg.—Bright sunshine 298·8 hours.

Mauritius.—Mean temp. of air 0°·4, and R 2·21 in., below, dew point 0°·4 above, averages. Mean hourly velocity of wind 9·3 miles, or 1·5 below average.

COLOMBO.—Mean temp. of air 75°·8, or 3°·2 below, of dew point 1°·2 below, and R 1·86 in. below, averages. Mean hourly velocity of wind 11·8 miles. TSS on the 25th.

HONGKONG.—Mean temp. of air 59°·7, or 3°·0 below average. Bright sunshine 168·2 hours. Mean hourly velocity of wind 9·1 miles.

Melbourne.—Mean temp. of air 1°·6 below, and R 1·41 in. above, averages.

Adelaide.—R 42 in. above average.

Coolgardie.—R 51 in. below average.

Perth.—R 48 in. below average.

Sydney.—Mean temp. of air 0°·2, and R 5·87 in., above, averages.

Wellington.—Mean temp. of air 0°·2 above, and R 3·38 in. above, averages. Bright sunshine 258·5 hours.

Auckland.—A muggy, showery month. R above average, and mean temp. below average.



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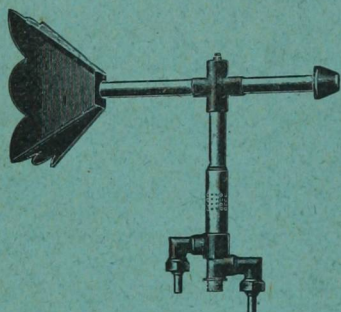
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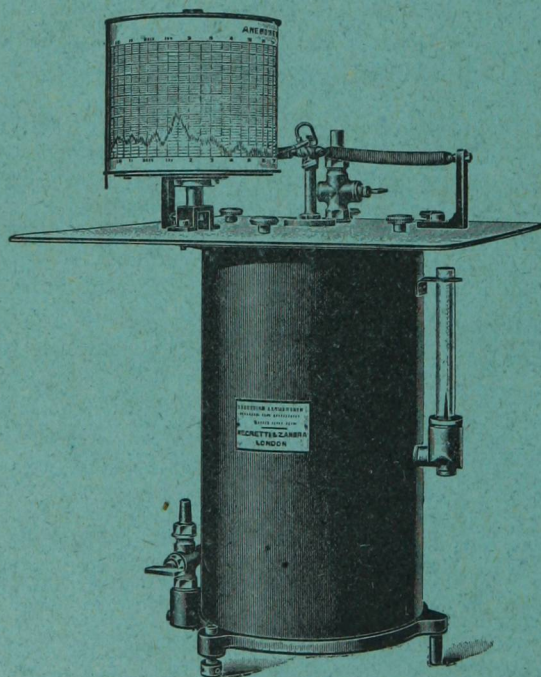
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