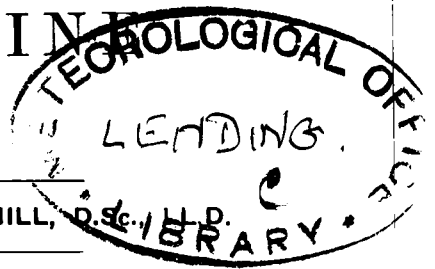


The map illustrates the distribution of high and low pressure systems across the Pacific Ocean. High pressure areas are marked with orange ovals, and low pressure areas are marked with blue ovals. The map includes latitude and longitude lines and labels for various regions like North America, South America, and the Pacific Islands.

Frontispiece.

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Edited by HUGH ROBERT MILL, D.Sc. F.R.S.



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Symons's Meteorological Magazine.

No. 565. FEBRUARY, 1913. VOL. XLVIII.

THE NEW VOLUME.

IN commencing our forty-eighth volume we may fitly throw a glance behind. It reveals in our past history much cause for satisfaction, and conscious as we are of many shortcomings, we cannot but feel that the *Magazine* would not have so far surpassed the fated span of other journals of the same character unless it had some special fitness for survival. The circulation has not grown rapidly, yet each year has numbered a few more subscribers than the last. We have never made an appeal to popular fancy or to the interests of the high specialist, but have striven rather to follow the middle course of endeavouring to supply those interested in making meteorological observations with information as to the current progress of meteorological research and literature expressed as simply as is compatible with accuracy. In addition, we offer so far as our space permits a perfectly open channel for the exchange of opinion on meteorological matters, barring only the palpably absurd or paradoxical.

It is a source of great satisfaction that a journal so humble in its aims and so unpretentious in appearance should receive the support of eminent meteorologists of all countries, so that in every volume there is something of permanent value that cannot be found elsewhere. The new volume will contain a series of important articles by Mr. R. C. Mossman, of which the first appears in the present number. The labour involved in dealing with the correlating of observations in distant places is only partly revealed in the articles themselves, but it is safe to say that there are few students of meteorology so enthusiastic as to undertake the drudgery necessary to produce such results.

SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

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

(of the Argentine Meteorological Office).

(First Article).

THE subject of synchronous compensation between the types of seasons at places situated in different parts of the Earth, and of the relation that exists between the sequence of weather at one place with the weather following at another place, even when the two localities are situated at a great distance from one another, is one that has of late years received increasing attention at the hands of meteorologists. Hildebrandsson, among a score of workers at this fascinating class of research, stands pre-eminent for his numerous contributions. In four papers on the "Centres of Action of the Atmosphere," he has given a large number of examples of this species of weather correlation, most of which refer to places in the northern hemisphere, where we possess many of the long and homogeneous series of observations so necessary for this form of research. In his fourth and last memoir * Hildebrandsson has carried his investigations into the southern hemisphere, being hampered considerably by the absence of data from regions where the southern "centres of action" are located. Having of late begun to collect data for South America with the object of preparing a general memoir on the climatology of that Continent, a considerable mass of material is already available for testing whether the South American weather sequences show as pronounced resemblances or contrasts when compared with data from other regions, as do those in the northern hemisphere. Cordoba in the Argentine Republic, it would appear, is the only station in South America with a long record situated in an "action centre," most other places referring to regions located in a transitional zone. While for the purposes of the present inquiry there is a lack of data from pronounced "action centres," still many of the stations are so placed that they serve as an index of the pulsations taking place in the neighbouring foci of cyclonic and anti-cyclonic activity. As will be apparent later, some of the correlations obtained lend considerable support to the opinion expressed by other workers that the action centres of the globe are mutually associated, and that abnormal conditions in one hemisphere are inter-twined, not only with simultaneous but in many cases subsequent exceptional features in the other half of the earth.

RELATION BETWEEN NILE FLOOD AND MAY TO AUGUST RAINFALL AT SANTIAGO (CHILE).

The height of the Nile flood, as has been shown by Captain Lyons,† is dependent on the June to September rainfall in Abyssinia. A

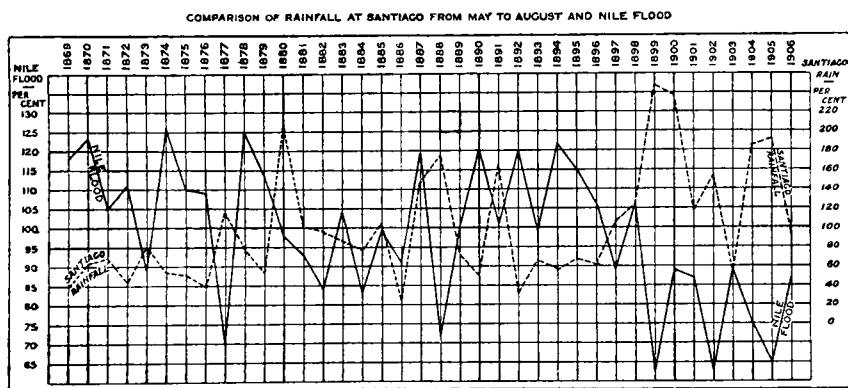
* Reviewed along with third paper in this Magazine, Vol. 45, p. 236.

† *Quar. Jour. Roy. Met. Soc.*, Vol. 36., p. 215.

relation is apparent if we compare the volume of the water passing Aswan between July 1st and October 31st with the corresponding southern winter rainfall of Santiago de Chile (Lat. $33^{\circ} 27' S$, Long. $70^{\circ} 42' W$, height 1,703 feet above sea). The data utilised for the Nile represent the ratios of the annual floods to a mean flood during the years 1869 to 1906. They are given in Captain Lyons' publication "The Rains of the Nile," 1906. The rain data for Santiago (see table) are taken from the series of volumes and reports issued by that observatory or from the reports of the recently established Meteorological and Geophysical Institute. The mean rainfall during the four months May to August at Santiago during the 38 years 1869-1906 is 11.82 inches, or 81 per cent. of the total annual fall. The relation between the Nile floods and the Santiago rainfall for each year from May to August in this period is as follows, the normal being taken as equal to 100 :

| Year. | Nile. | Santi- ago. | Year. | Nile. | Santi- ago. | Year. | Nile. | Santi- ago. | Year. | Nile. | Santi- ago. |
|-------|-------|----------------|-------|-------|----------------|-------|-------|----------------|-------|-------|----------------|
| 1869 | 118 | 39 | 1879 | 114 | 54 | 1889 | 100 | 72 | 1899 | 63 | 248 |
| 1870 | 123 | 63 | 1880 | 98 | 206 | 1890 | 120 | 51 | 1900 | 89 | 237 |
| 1871 | 105 | 69 | 1881 | 93 | 101 | 1891 | 101 | 166 | 1901 | 87 | 118 |
| 1872 | 111 | 44 | 1882 | 84 | 96 | 1892 | 120 | 32 | 1902 | 63 | 153 |
| 1873 | 84 | 81 | 1883 | 104 | 87 | 1893 | 99 | 66 | 1903 | 89 | 55 |
| 1874 | 126 | 54 | 1884 | 83 | 78 | 1894 | 122 | 58 | 1904 | 75 | 185 |
| 1875 | 110 | 52 | 1885 | 99 | 106 | 1895 | 115 | 67 | 1905 | 65 | 192 |
| 1876 | 109 | 39 | 1886 | 91 | 25 | 1896 | 106 | 62 | 1906 | 87 | 92* |
| 1877 | 70 | 116 | 1887 | 119 | 148 | 1897 | 89 | 107 | | | |
| 1878 | 125 | 78 | 1888 | 72 | 175 | 1898 | 106 | 126 | | | |

These results are graphically shown in the following diagram :



* It may be of interest to give the ratio which the Santiago rainfall during the last six years (period May to August), bears to the normal, 1869-1906. The values are 1907, 64 % ; 1908, 51 % ; 1909, 48 % ; 1910, 76 % ; 1911, 38 % ; 1912, 86 %. We should, therefore, expect the Nile Floods of these years to be above normal, except possibly in the year 1907 when many well established correlations broke down.

The co-efficient of correlation deduced from these figures is 0.62* and the probable error 0.07.

The diagram shows that there is on the whole a strongly pronounced opposition between the height of the Nile flood and the winter rainfall at Santiago. During certain groups of years the opposition is relatively weak but in general the two curves present a strong contrast to each other. The winter rainfall at Santiago is common with other stations between the parallels of 32° and 39° south latitude especially on the littoral, varies with the position of the South Pacific high pressure area. Antarctic observation notably these of the "Belgica" in 1898-1899, and of Dr. Charcot in the years 1904, and 1909, show an undoubted see-saw movement of pressure at this season between the South Pacific anti-cyclone and the corresponding low pressure area, situated at the latitude of the Antarctic Circle in the southern extension of the South Pacific, known as the Bellingshausen Sea.† In some years this low pressure belt is deflected to the west owing to the extension northward of a portion of the Antarctic anti-cyclone over Graham's Land which is located on the Cape Horn meridian. Under these conditions cyclonic systems instead of pursuing their normal path south of Cape Horn approach the coast of Chile in low latitudes bringing increased rainfall and high temperatures due to the prevailing northerly winds, over the Santiago region. On the other hand, when the South Pacific anticyclone is south of its normal position, the Antarctic anticyclone recedes, the cyclonic area to the west of Graham's Land is deepened, so that the storm centres pass far to the

* We can carry the comparison of the relation of the Nile Flood—Santiago rainfall back to 1849 by means of the data giving the mean reading of the gauge at the Delta Barrage for the months July to October (see Craig—"A Meteorological Triangle," *Quar. Jour. Roy. Met. Soc.*, Vol. 36., p. 352). Previous to 1867 only the mean annual totals of Santiago rainfall are available, but as four-fifths of the yearly quantity falls from May to August, the data are fairly comparable with the Nile data. There are no annual rain totals for Santiago in 1851 and 1852, and no Nile data for 1859, but taking the 17 years common to both series in the period 1849-1868, we obtain a negative correlation co-efficient of 0.66, and a probable error of 0.09. The Santiago rain totals for these years are taken from the following publication, issued by the Santiago Observatory, viz. :—"Seccion de Meteorologia, Santiago de Chile, 1901, p. 117." The ratios referred to the means of the 17 years, 1849-50, 1853-58, 1860-68, are as follows :—

| Year. | Nile. | Santiago. | Year. | Nile. | Santiago. | Year. | Nile. | Santiago. |
|-------|-------|-----------|-------|-------|-----------|-------|-------|-----------|
| 1849 | 97 | 81 | 1857 | 93 | 58 | 1864 | 102 | 140 |
| 1850 | 96 | 141 | 1858 | 89 | 158 | 1865 | 96 | 66 |
| 1853 | 106 | 54 | 1860 | 98 | 131 | 1866 | 112 | 42 |
| 1854 | 111 | 118 | 1861 | 117 | 93 | 1867 | 97 | 61 |
| 1855 | 86 | 139 | 1862 | 100 | 107 | 1868 | 80 | 152 |
| 1856 | 107 | 140 | 1863 | 112 | 22 | | | |

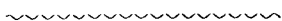
† See papers by the writer in *Scottish Geographical Magazine*, August, 1910 and pp. 411-416 and *Journ. Scot. Met. Soc.* Vol. 15, pp. 317-318.

Rainfall at Santiago, Chile, 1867-1911.

| YEAR. | Jan. | Feb. | Mar. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | YEAR. |
|-------|------|------|------|--------|------|-------|-------|-------|-------|------|------|------|-------|
| | in. | in. | in. | in. | in. | in. | in. | in. | in. | in. | in. | in. | in. |
| 1867 | ... | ... | ... | 10 | 1.21 | 3.14 | 3.71 | .71 | .02 | ... | .26 | .22 | 9.37 |
| 1868 | ... | ... | ... | .92 | .69 | 2.93 | 5.62 | 2.12 | 9.83 | 1.10 | ... | .35 | 23.56 |
| 1869 | ... | ... | .39 | ... | 1.72 | .06 | 1.65 | 1.19 | .51 | .35 | ... | ... | 5.87 |
| 1870 | ... | ... | .20 | ... | .92 | 4.44 | 2.01 | .11 | .03 | .34 | ... | ... | 8.05 |
| 1871 | ... | .70 | .83 | .53 | 2.13 | 2.28 | 2.71 | 1.06 | 1.37 | .23 | ... | ... | 11.84 |
| 1872 | ... | ... | .12 | ... | 1.72 | 1.46 | .29 | 1.76 | .87 | ... | ... | ... | 6.22 |
| 1873 | ... | .06 | ... | .43 | 1.01 | 1.54 | 3.35 | 3.67 | 1.31 | ... | ... | .24 | 11.61 |
| 1874 | ... | ... | .09 | ... | 1.83 | 3.59 | .47 | .50 | 1.39 | .67 | 1.84 | ... | 10.38 |
| 1875 | .02 | .65 | ... | .02 | 4.28 | .68 | 1.17 | ... | ... | ... | .21 | 2.37 | 9.40 |
| 1876 | ... | ... | .54 | .36 | 1.49 | .83 | .61 | 1.67 | .76 | 1.60 | .13 | ... | 7.99 |
| 1877 | .07 | .03 | ... | 5.14 | 1.96 | .94 | 10.40 | .46 | 3.86 | 2.70 | .01 | ... | 25.57 |
| 1878 | .15 | .44 | .98 | 4.37 | 3.60 | 2.88 | 1.83 | .93 | .45 | ... | .15 | ... | 15.78 |
| 1879 | ... | ... | ... | ... | 1.40 | 2.92 | .85 | 1.21 | ... | .13 | ... | ... | 6.51 |
| 1880 | ... | .08 | .02 | .32 | 1.13 | 9.24 | 10.59 | 3.52 | .33 | .40 | .07 | ... | 25.70 |
| 1881 | .23 | ... | ... | 1.00 | 2.46 | 3.43 | 3.58 | 2.46 | 2.90 | .79 | .51 | ... | 17.36 |
| 1882 | ... | .06 | ... | ... | 1.59 | 1.29 | 6.32 | 2.18 | .34 | ... | .18 | ... | 11.96 |
| 1883 | .46 | ... | .02 | .01 | 4.71 | 3.30 | 1.80 | .48 | 3.03 | .57 | ... | ... | 14.38 |
| 1884 | ... | ... | 1.06 | 1.28 | .25 | 2.43 | 1.93 | 4.59 | 1.22 | .35 | .28 | 1.87 | 15.26 |
| 1885 | .02 | .04 | ... | .12 | 6.12 | .31 | 4.30 | 1.84 | 1.89 | .95 | .06 | ... | 15.65 |
| 1886 | ... | ... | ... | ... | .56 | .50 | .71 | 1.23 | .39 | .11 | .21 | 1.28 | 4.99 |
| 1887 | ... | .57 | ... | .03 | .15 | 6.29 | .12 | 10.96 | 2.31 | 1.13 | .62 | ... | 22.18 |
| 1888 | ... | ... | ... | .60 | 1.08 | 5.00 | 6.24 | 8.36 | 3.65 | 1.61 | .76 | ... | 27.30 |
| 1889 | .06 | ... | ... | .24 | 1.77 | .84 | 4.02 | 1.89 | .02 | .12 | .01 | .08 | 9.03 |
| 1890 | .09 | ... | .06 | 1.52 | .21 | 1.50 | 2.49 | 1.90 | .93 | .05 | ... | .01 | 8.76 |
| 1891 | ... | ... | ... | .94 | 4.62 | 5.88 | 8.95 | .25 | ... | 3.33 | .11 | .12 | 24.20 |
| 1892 | ... | ... | ... | ... | .35 | .45 | 1.00 | 1.95 | .16 | .27 | .70 | ... | 4.88 |
| 1893 | ... | ... | ... | .16 | 2.30 | 2.07 | 2.28 | 1.13 | .04 | ... | .99 | .46 | 9.43 |
| 1894 | .02 | ... | .61 | .46 | 2.22 | 1.54 | 1.04 | 2.03 | .59 | .04 | .05 | ... | 8.60 |
| 1895 | .01 | ... | .74 | .43 | .06 | .34 | 1.63 | 5.91 | 1.76 | .33 | .21 | .01 | 11.43 |
| 1896 | ... | ... | .03 | .10 | .05 | 1.25 | 4.04 | 1.94 | 2.71 | .24 | ... | ... | 10.36 |
| 1897 | .08 | .02 | .18 | .01 | 8.13 | 1.78 | 2.06 | .77 | .32 | .60 | ... | ... | 13.95 |
| 1898 | ... | ... | .01 | 1.82 | 1.17 | 9.57 | 2.58 | 1.67 | .91 | 1.20 | .62 | .09 | 19.64 |
| 1899 | ... | .01 | .04 | .02 | 1.42 | 9.27 | 6.33 | 12.31 | .66 | .39 | ... | ... | 30.45 |
| 1900 | ... | .02 | .85 | .09 | 4.83 | 5.13 | 13.89 | 4.27 | .76 | 2.42 | ... | ... | 32.26 |
| 1901 | ... | .02 | .19 | .02 | 2.80 | 4.32 | 2.67 | 4.16 | .01 | .80 | .02 | .01 | 15.02 |
| 1902 | ... | .18 | .21 | .02 | 4.13 | 5.92 | 7.35 | .70 | .32 | .25 | .84 | ... | 19.92 |
| 1903 | .01 | ... | .03 | .83 | 1.05 | 3.92 | 1.51 | .02 | .04 | .24 | .01 | ... | 7.66 |
| 1904 | ... | .04 | 1.42 | .23 | 9.14 | 3.08 | 6.76 | 2.90 | .81 | .64 | .12 | 1.89 | 27.03 |
| 1905 | ... | ... | .10 | .08 | 6.13 | 7.32 | 7.07 | 2.20 | .86 | .33 | .01 | .13 | 24.23 |
| 1906 | .03 | .32 | ... | .02 | 4.42 | 1.60 | 1.42 | 3.47 | .26 | ... | .01 | ... | 11.55 |
| 1907 | ... | .03 | ... | .69 | 2.19 | 3.15 | 1.35 | .83 | 1.79 | .37 | .01 | .19 | 10.60 |
| 1908 | .02 | .05 | ... | 1.67 | 1.17 | 3.28 | .34 | 1.23 | .20 | ... | ... | ... | 7.96 |
| 1909 | ... | ... | ... | .07 | .43 | 3.50 | .87 | .83 | 1.26 | .18 | .01 | .12 | 7.27 |
| 1910 | ... | ... | .41 | .62 | .04 | 6.24 | 1.43 | 1.25 | .04 | .13 | .31 | .20 | 10.67 |
| 1911 | ... | ... | ... | .83 | 1.02 | 1.78 | 1.18 | .46 | .62 | .01 | ... | .80 | 6.70 |
| Mean | .03 | .07 | .20 | .58 | 2.26 | 3.18 | 3.39 | 2.34 | 1.14 | .56 | .21 | .23 | 14.19 |

south. At Santiago under these conditions dry weather accompanied by radiation cold, prevails.

Until quite recently there was no suitably placed station in the South Pacific by which to determine the relations obtaining from season to season between the South Atlantic and South Pacific high pressure belts. There is a short and in the past not very reliable record from Juan Fernandez, which last year has been equipped with a very complete set of instruments by the Chilian Meteorological Office, and is now in radiographic communication with the mainland. This, along with the observations at a new station on Easter Island (Lat. 27° S., Long. 109° W.), should give us full and immediate information regarding the seasonal oscillations in the position of the South Pacific anti-cyclone. When these data come to be compared in a few years time with data from St. Helena, I have little doubt that the chain linking up the rainfall of Abyssinia with the Antarctic circulation will be complete. If this can be established then the matter becomes of great interest to the student of Antarctic meteorology and glaciology, since from the records of the Nileometers, which embrace centuries of observation, it will be possible to obtain some idea of the sequence of weather changes since the time of the Pharoahs in the far South Pacific during the austral winter months.



ROYAL METEOROLOGICAL SOCIETY.

THE annual general meeting of the Royal Meteorological Society was held on January 15th, at the Surveyors' Institution, Westminster, Dr. H. N. Dickson, President, in the chair.

In submitting their report for the year 1912 the Council noted that the roll of Fellows was slightly diminished. Deep regret was expressed for the loss of the Society's Treasurer, Dr. C. Theodore Williams. The co-operation with the Meteorological Office, foreshadowed in the report for 1911, was stated to be in operation, the *Monthly Weather Report* now taking the place of the *Meteorological Record* for the publication of the observations. The Society's staff were at present engaged in the preparation of a series of normal values of the climatological elements of the British Isles. The work on barometric pressure was well advanced. Mr. Marriott had lectured on behalf of the Society at numerous Scientific and Literary Institutions and Schools during the year. Special emphasis was laid on the researches in the upper atmosphere, which had been continued and extended.

The President, in moving the adoption of the Report, expressed his opinion that the diminution in numbers indicated no lack of interest. The liberal supply of papers and discussions were, he said, sufficient to guarantee the health of the Society. He considered that advance in system, rather than new discoveries, had been the noteworthy feature of the meteorology of the year. He felt justified in believing

in a new wave of popular interest in the subject, especially in a spontaneous increase in agricultural interest. The Report was adopted and a special vote of thanks was passed to the President for his untiring efforts during two critical years of office.

The following gentlemen were elected to serve on the Council for the 1913 session. *President*: Mr. C. J. P. Cave; *Vice-Presidents*: Dr. Chree, F.R.S., Dr. H. N. Dickson, F.R.S.E., Mr. R. H. Hooker, Capt. H. G. Lyons, D.Sc., F.R.S.; *Treasurer*: Mr. F. Druce; *Secretaries*: Mr. F. Campbell Bayard, LL.M., Commr. W. F. Caborne, C.B.; *Foreign Secretary*: Dr. R. H. Scott, F.R.S.; *Councillors*: Mr. C. L. Brook, Mr. W. W. Bryant, Mr. E. Gold, Mr. R. Inwards, Mr. Baldwin Latham, C.E., Mr. R. G. K. Lempfert, Lt.-Col. H. Mellish, Col. H. E. Rawson, C.B., Mr. C. Salter, Capt. A. Simpson, Sir J. W. Towse, and Commr. D. Wilson-Barker, F.R.S.E.

A paper on "The Snowfall of the United States," by C. F. Brooks, was read in the absence of the author. The author pointed out that until 1883 but little attention was given to the subject of snowfall, but more recently the great interest in water supply from snowfall led Professor Bigelow to experiment with various forms of snow bins in the mountains of Wyoming. The number of reporting stations varied in different years, but for the 15 years dealt with by the author, July, 1895 to June, 1910, reports were available from nearly 3,000 stations, of which 159 had a continuous record for the 15 years. The effects on snowfall of land relief, prevailing winds, storm frequency, and proximity to the Great Lakes, are very apparent. The prevailing westerly winds from the Pacific Ocean bring a snowfall in many places of over 400 inches per year on the western slopes of the Sierra Nevada and Cascade ranges. The dry interior basin to the leeward has little snow, but on the Rocky Mountains as much as 300 inches per year falls in Southern Wyoming and 400 inches in some places in Colorado. The dry western prairies suffer a deficient fall, but on nearing the Great Lakes the fall increases, from 80 to more than 100 inches falling annually on their south-east shores. The Gulf Stream shows its influence as far as Cape Hatteras by bending the lines of equal snowfall far to the north.

In the course of an interesting discussion Mr. Gold said that he considered the most important information would be the depth of snow on the ground at various dates rather than the aggregate depth of snowfall. Mr. Hooker drew attention to the fact that the observations provided the necessary data for testing the accuracy of the assumed ratio 1:10 used for converting the depth of snow to its rainfall equivalent. Mr. Baldwin Latham gave examples of the inaccuracy of measuring snow by a rain gauge and was of opinion that with wet snow a ratio of even 1:5 might hold.

The following new Fellows were elected: Messrs. C. A. A. Barnes, W. G. Kendrew, R. T. Lennon, John Rees, J. H. Robinson, E. H. Sills G. I. Taylor.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

A RAINFALL QUERY.

I SHALL state your correspondent's query somewhat more definitely than he has done, and for convenience shall use metric measures as I have no graphic means at hand for the calculation, whereas for metric measures Neuhoff's modification of Hertz's diagram, given in the *Abhandlungen des K. Preuss. Met. Instituts*, Bd. I. No. 6. p. 273, is very convenient. The equivalent English measures are given in brackets.

A kilogram (2·2 lbs) of dry air at 15°C (59° F) and 760 mm. sea-level (29·92 in.) contains enough moisture, 10·6 g. (164 gr.), to saturate it. It is carried up a mountain 2,400 m. (7,826 ft.) high, along a slope of 1 vertical to 5 on the slant (this will save fractions), at a velocity of 30 km. (about 20 miles) per hour: find the precipitation on the mountain.

The following table from Neuhoff's diagram gives the successive states:—

| Height. | | Time | Temperature. | | Specific humidity. | | Loss of moisture. | | Pressure. | | Vol- ume. |
|---------|--------|------|--------------|--------|--------------------|----------|-------------------|----------|-----------|---------|----------------|
| m. | (ft.) | min. | °C. | (°F.) | g. | (grains) | g. | (grains) | mm. | (in.) | m ³ |
| 0 | (0) | 0 | 15·0 | (59·0) | 10·6 | (164) | 0·0 | (0·0) | 760·0 | (29·92) | ·830 |
| 300 | (978) | 3 | 13·6 | (56·5) | 10·0 | (154) | 0·6 | (9·3) | 734·0 | (28·90) | ·850 |
| 600 | (1957) | 6 | 12·1 | (53·8) | 9·4 | (145) | 1·2 | (18·5) | 709·0 | (27·91) | ·890 |
| 900 | (2935) | 9 | 10·6 | (51·0) | 8·8 | (136) | 1·8 | (27·8) | 684·3 | (26·94) | ·922 |
| 1200 | (3913) | 12 | 9·0 | (48·2) | 8·2 | (127) | 2·4 | (37·0) | 660·0 | (25·98) | ·956 |
| 1500 | (4891) | 15 | 7·4 | (45·4) | 7·6 | (117) | 3·0 | (46·3) | 636·5 | (25·06) | ·990 |
| 1800 | (5870) | 18 | 5·8 | (42·4) | 7·1 | (110) | 3·5 | (54·0) | 613·5 | (24·15) | 1·027 |
| 2100 | (6848) | 21 | 4·2 | (39·6) | 6·6 | (102) | 4·0 | (61·7) | 591·8 | (23·30) | 1·066 |
| 2400 | (7826) | 24 | 2·6 | (36·6) | 6·2 | (96) | 4·4 | (67·9) | 570·5 | (22·46) | 1·106 |

One kilogram of dry air at 0° and 760 mm. pressure, measures 0·773 cubic metres and 0·816 at 15°; and 10·6 g. water vapour at 15° occupies the same space as $10·6 \times \frac{8}{5}$ g. of dry air, *i.e.*, 0·014 cubic metre. Hence the volume of the damp air at 15° and 760 mm. is 0·830 cubic metre. We shall suppose this volume to be in the shape of a vertical prism whose base is 1 metre square and altitude 83·0 centimetres, or if we neglect the small change of volume as the condensed water falls away from the mixture, we may take this 83·0 cm. as the equivalent depth of the prism at sea-level, and 15°. The successive volumes are given in the last column of the table.

The horizontal distance corresponding to 1,500 m. along the slope of the hill is 1,470 m. ($\frac{1}{5} = \sin 11^{\circ} 32'$; $\cos 11^{\circ} 32' = 0·98$), and the air is carried over this distance in 3 minutes. Thus in

rising say from 900 m. to 1,200 m. it loses 0·6 g. moisture in 3 minutes, over an area of 1·470 square-metres, which is at the rate of 288 g. per day, or practically ·0002 mm. of rain. If, however, the kilogram we are studying is not an isolated mass, but forms part of a continuous succession of similar masses, each will deposit its quota, and there will be 1,470 in all. The result would be a rainfall of 0·288 mm. per day, and this from a prism 0·830 mm. deep at the start. To obtain 1 mm. of rain (0·04 in.), a column of height 2·86 m. (9·30 ft.), would have to be moved. Since, however, not all the condensed moisture is deposited as rain, in practice the column required would have to be increased in the ratio of the water condensed to the rain that falls, which recent work in Germany shows to be about 10 to 1. The water which does not fall to the ground as rain is retained as cloud in the moving air through which it drops comparatively slowly. So when the summit of the mountain is reached some of the drops which are still falling are carried on past the crest and give precipitation on the lee side of the mountain.

Provided all the water has been removed from the air when it begins its descent, there will be no more condensation. For the air will be heated just as much by compression in the descent as it was cooled by expansion in the ascent, and in addition will retain the heat liberated by the condensation of 4·4 g. of vapour, in the case in point. In practice, however, only a part of the water is removed or say 2·0 g. leaving 2·4 g. in a state of suspension as "Scotch mist." In this case the air on its descent would repeat the operations of ascent in the reverse order till it reached 1,200 m., when all the retained water would be re-evaporated, and the equivalent latent heat absorbed. There would still, however, be the latent heat corresponding to the lost 2·0 g. and from 1200 m. down the air would describe the following set of conditions.

| Height (metres). | Temperature. | | Relative humidity. |
|---------------------|--------------|------------|-----------------------|
| | ° C. | ° F. | |
| 1200 | 9·0 | ... (48·2) | 100 |
| 900 | 12·2 | ... (54·0) | 84 |
| 600 | 15·3 | ... (59·6) | 71 |
| 300 | 18·4 | ... (65·2) | 61 |
| 0 | 21·3 | ... (70·4) | 51 |

This is the explanation of the *föhn* wind, and of the dryness and warmth of the sheltered side of mountains.

If the speed of the current is changed, the rate at which the air mounts from one altitude to another changes and the rate of loss of water changes in the same ratio. If the speed is reduced to 15 km. (10 miles) per hour, the above losses will take place in double the time, and the daily rainfall will be halved. As the drops fall at the same rate, but are carried forward at half the speed, the rainfall on the lee side will extend to only half the distance that it did in the earlier case.

J. I. CRAIG.

“ RAINFALL ” OR “ PRECIPITATION. ”

MAY I suggest that instead of using the word “Rainfall” we should use “Precipitation” whenever we refer to a rainfall record which includes the fall of snow, hail, etc., in addition to actual rain.

Of course, the word “Rainfall” has included almost all forms of precipitation for a great number of years but this is not, perhaps, a very satisfactory reason why we should still adhere to what may be called a “terminological inexactitude.”

JAS. B. ESPINER, F.R.Met.Soc.

Ivy House, West Witton, Leyburn, Yorks., 5th February, 1913.

THE WEATHER OF JANUARY 11th, 1913.

THE easterly gale so disastrous round our coasts, of Saturday, January 11th, which brought such a severe blizzard in the more northern portions of the kingdom with such huge drifts, especially in Dumfriesshire, occasioned an icy rain in the south of England with weather of the worst possible description. Walking out on deserted Hampstead Heath that afternoon in a driving fog and a high gale slashing pellets of ice into my face, in a heavy gloom unrelieved by the snow which, as I suspected, would be falling a little farther north in the Midlands, it struck me most forcibly as about the most gruesome type of winter day one could well imagine. A rook or two walking about in a sodden field was all the bird life in evidence in such conditions.

L. C. W. BONACINA.

January, 22nd, 1913.

METEOROLOGICAL NEWS AND NOTES.

PHOTOGRAPHY IN NATURAL COLOURS has secured an interesting record in a fine picture of red snow taken by Mr. Ford A. Carpenter and published by him in the Transactions of the San Diego Society of Natural History (Vol. 1., 1911, p. 108). The photograph, which is an extremely beautiful one, shows an effect very similar to snow reflecting a red sunset, and it was taken on July 13th, 1911, from the Vogelsang Pass at an elevation of 10,000 feet, in the Sierra Nevada of California, above the Little Yosemite Valley. The appearance, as is well known, is due to the minute alga known as *Sphaerella* (formerly styled *Protococcus*) *nivalis*. The photograph, so far as we are aware, is unique.

ERRATUM.—In the remarks on the Weather of December, published in our last issue, it was incorrectly stated that in London the total rainfall on Christmas Day and Boxing Day “was the heaviest recorded at such a time for at least 40 years past.” The statement should read, “was the heaviest recorded since the year 1886, when the rainfall and heavy snowstorms of Boxing Day yielded 1·82 in. at Brixton.

Charles Theodore Williams, M.D., M.V.O.

AUGUST 29TH, 1838—DECEMBER 15TH, 1912.

THE death on December 15th, 1912, of Dr. C. Theodore Williams, takes from our midst one of the foremost leaders of thought in connection with the relation of meteorological and climatological science with the health of the community. Dr. Williams was probably best known as a distinguished physician and authority on the treatment and prevention of tuberculosis. He leaves numerous memorials in the hospitals and sanatoria, the institution of which he so actively and brilliantly promoted during his long and useful career.

It was chiefly in connection with the climatic treatment of consumption that Dr. Williams became prominent in meteorological circles, and his numerous writings and lectures on the subject brought him a high reputation. Dr. Williams shared with the late Mr. G. J. Symons the distinction of having twice occupied the presidential chair of the Royal Meteorological Society. He held this office for the first time during 1892 and 1893, and on the death of Mr. Symons in 1900 was again elected, in order to carry out the responsible and arduous task of piloting the Society through the unusual activity of its Jubilee year. He was the Honorary Treasurer of the Society from 1898 to the day of his death, with the exception of the period of his Presidency, and all who have had the privilege of sitting on the Council, of which he was an *ex-officio* member, will long remember the help and the wise advice which he was always ready to give, and which his wide experience rendered so valuable.

Léon Philippe Teisserenc de Bort.

NOVEMBER 5TH, 1855—JANUARY, 1913.

WE learn with the deepest regret of the death, at the age of 57, of the distinguished French meteorologist M. Léon Teisserenc de Bort, whose brilliant work had placed him in the front rank of modern scientific investigators.

M. Teisserenc de Bort's connection with official meteorology dates from 1880, when he entered the Bureau Central Météorologique, under the directorship of Mascart. He remained an official of that Institute till 1892, after which date he retained only the honorary position of meteorologist, and carried his activities into a wider circle. His greatest contributions to meteorological knowledge, and they are very great ones, were in connection with upper air research, carried on largely at the specially erected observatory at Trappes, near Paris, of which he was the founder. His well-known chart of the mean pressure distribution, at a height of 4000 metres, marked a distinct advance towards the ultimate solution of one of the most difficult

and at the same time one of the most urgent of the problems which engage the attention of meteorologists to-day. The development of observational work by means of kites, and more recently by means of *ballons sondes*, owes much to his energies, and his association with the late Professor Lawrence Rotch was productive of far reaching and extremely useful results. M. Teisserenc de Bort was a pioneer of the movement towards world-meteorology, which we are convinced will prove one of the greatest triumphs of our science in the early part of the twentieth century, and he recognised to the full the value of co-operative work in carrying out meteorological investigations.

In 1908 the Royal Meteorological Society awarded to M. Teisserenc de Bort the Symons Gold Medal, in recognition of his eminent services to the science of meteorology, and his presence in London on that occasion added greatly to the pleasure with which we saw that distinction conferred.

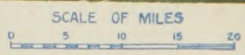
SCOTTISH METEOROLOGICAL SOCIETY.

THE annual business meeting of the Society was held in the Gool'd Hall, 5, St. Andrew's Square, Edinburgh, on the 10th December, Professor A. Crum Brown, F.R.S., President, in the chair.

The Report from the Council was adopted. A considerable shrinkage had occurred in the membership of the Society, due largely to the deaths of subscribers of long standing, and but for a considerable demand for the Society's publications, there would have been a serious deficit for the financial year ending 30th June last. The expenditure of the Society had been reduced to the lowest possible limit, but it would exceed the income for the current year unless there was a large accession of new members. In March, 1912, the Council had lodged an application with the Registrar General for Scotland for a grant sufficient to defray the entire cost of the reports supplied to him by the Society. That application was forwarded by the Registrar General to the Scottish Office, and by the Secretary of State for Scotland to the Treasury. The Council had so far not received a reply to their application, but were aware that it had been under consideration.

The following were appointed Office-bearers and Council for the ensuing twelve months:—*President*: Mr. J. Mackay Bernard, F.R.S.E.; *Vice-Presidents*: Dr. C. G. Knott, Sec.R.S.E. and Mr. Gilbert Thomson, F.R.S.E.; *Council*: Mr. H. M. Cadell, F.R.S.E., Sir A. Buchan-Hepburn, Bart., Mr. G. G. Chisholm, Mr. M'C. Fairgrieve, F.R.S.E., Prof. A. Crum Brown, M.D., LL.D., F.R.S., F.R.S.E., Mr. J. R. Milne, D.Sc., F.R.S.E., Mr. T. S. Muir, Prof. R. A. Sampson, D.Sc., F.R.S., F.R.S.E., Mr. James Watt, W.S., F.R.S.E.; *Hon. Secretaries*: Mr. R. T. Omond, F.R.S.E. and Mr. E. M. Wedderburn, W.S., F.R.S.E.; *Hon. Treasurer*: Mr. W. B. Wilson, W.S.

THAMES VALLEY RAINFALL — JANUARY, 1913.



Thereafter Dr. J. R. Milne, Lecturer on Natural Philosophy, the University, Edinburgh, communicated a paper on "Atmospheric Cooling," in which he described some important experiments at which he had been at work for some time. It was well known that the effect on the human body of any given temperature might be different at different times. A very considerable degree of cold could be endured on a calm day which would be intolerable with a strong wind, and high temperatures could be endured comfortably in a dry atmosphere which would become exceedingly trying when the air was humid. The aim of the experiments had been to measure the rate at which heat was given out under different conditions, and so far the experiments had taken account of temperature and wind velocity. The apparatus used had been finally adopted after many preliminary trials. A small cylinder of thin copper with a blackened hemispherical top was placed on the tower of the University Laboratory, the cylindrical part being insulated with plaster of Paris and the top alone exposed. This vessel was filled with paraffin oil, and the amount of electrical energy necessary to maintain the oil at blood heat was continuously recorded, as were the velocity of the wind and the air temperature. The results of the experiments were indicated in a general way by means of lantern slides.

Prof. Sampson, F.R.S., congratulated Dr. Milne on opening up an interesting field for research. He disliked the term "psuchrainometer," which had been applied to the apparatus used. Dr. C. G. Knott, Principal Crichton Mitchell and others took part in an interesting discussion, and Dr. Milne in reply said that he had selected the least objectionable of the terms which had been suggested to him by a competent philologist to describe an instrument designed to measure the rate of cooling.

In reply to a question Mr. A. Watt made some remarks on the phenomenon of "glazed frost," of which an example had occurred in Edinburgh and elsewhere on the forenoon of December 3rd. A period of extremely severe frost came to a sudden end with a slight fall of rain, and immediately the streets became covered with a thin sheet of ice. Whilst such an ice sheet might be to some extent due to the freezing of the rain owing to the coldness of the ground, a sheet of any considerable thickness could be formed only if the rain were super-cooled, suddenly freezing on touching any solid object.

THE WEATHER OF JANUARY.

DURING the beginning of the month a southerly to south-westerly type of pressure distribution prevailed over the United Kingdom, and gales occurred frequently on the western and north-western coasts, and at times on the southern, eastern and north-eastern coasts also. Temperature was above the average practically everywhere,

and on the 4th the maxima reached 50° or above at many stations in the south and east of England and at Dublin. Gales continued along the western coasts during the commencement of the second week and temperature remained high, readings of 45° to 50° being general between the 7th and 9th. On the 7th 55° was reached at Crieff and 56° at Gordon Castle. A small secondary depression developed over the east of England on the 11th, and was accompanied by heavy rain in the southern counties and much snow in the north and central parts of Great Britain. A depth of 12 inches was reported in many places, and $17\frac{1}{2}$ inches at Crieff. Pressure increased on the 12th, and the day was fine in the south and south-east of England, but snow fell in the east and north. Thick fog prevailed in London and at some places in the Midlands and north of England on the 13th, and temperature remained low. The lowest temperatures of the month were recorded on this and the following day when shade minima of 16° were registered at Buxton and Nottingham, 15° at Marchmont, 13° at Harrogate, 11° at West Linton, and 10° at Newton Rigg. Unsettled conditions continued generally, and on the 18th a depression moved eastward from Denmark and temperature remained below 40° at stations in the north and east of England, but rose to nearly 50° in the south-west of the British Isles. Dull wet weather was experienced generally during the days following, and temperature seldom rose above the normal. During the night of the 22nd, however, a decided rise took place, and readings a little over 50° were recorded on the 23rd at many places in the south and west, though the maxima were below 40° in the north and north-east, and only 35° was reached at Nairn. A steady increase of pressure over the kingdom on the 25th with winds from some northerly point resulted in lower temperatures, and frosts occurred in most places during the night. Anticyclonic conditions prevailed on the 26th, and pressure exceeded 30.3 inches over a large area. As this system passed away to Germany temperature rose briskly in the west and south, and reached 50° at Valencia and Scilly and 52° at Jersey. Temperature fluctuated generally on the 27th and 28th, and the weather was of a changeable character with rather frequent and heavy rain. A rise in temperature occurred in most parts of the kingdom on the 29th or 30th, and on the latter day the shade maxima ranged from 55° at Killarney and 53° in the Midlands and south-west of England to a trifle below 50° in Scotland and the north-east of England.

The rainfall of the month was generally in excess of the average, except in the north of Scotland. The general fall over the great divisions of the United Kingdom expressed as a percentage of the average was as follows :—England and Wales, 174 ; Scotland, 98 ; Ireland, 179 ; British Isles, 155.

The duration of bright sunshine was below the average in all parts of the kingdom, the area of least deficiency being the south-east of England.

INTERNATIONAL BALLOON ASCENTS.

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

June 2nd, 1910.

| Starting Point. | Country. | A miles. | B ° F. | C miles | D ° F. | E miles. | F |
|-------------------|--------------|-------------|-----------|------------|-----------|-------------|----------|
| Manchester.... | England | 6·9 | —63 | 10·3 | —56 | 86 | N.E. |
| Ditcham Park.. | „ | 6·9 | —56 | 9·2 | —54 | 125 | N.E.byN. |
| Brussels | Belgium | 7·4 | —78 | 10·9 | —65 | 44 | N.E.byN. |
| Paris..... | France | 6·9 | —71 | 9·4 | —62 | 82 | N.E.byN. |
| Hamburg..... | Germany.... | 7·0 | —81 | 9·3 | —60 | 56 | N.E. |
| Lindenberg ... | „ | 7·2 | —69 | 9·3 | —60 | 36 | N.E.byE. |
| Strassburg | „ | 7·2 | —78 | 9·9 | —62 | 57 | N.E.byN. |
| Nizhni Olchedaëff | Russia | 7·3 | —62 | 10·2 | —45 | 11 | S.S.W. |

On June 2nd the pressure was very irregular. A minimum had moved to the north-east, from Scandinavia, and another had come to Ireland from the north. An anti-cyclone lay over East Germany. The heights of the isothermal are very uniform, but not so the temperatures. This is unusual, for, as a rule, the height of the isothermal is very closely, but negatively, correlated with the temperature.

July 7th, 1910.

| Starting Point. | Country. | A miles. | B ° F. | C miles. | D ° F. | E miles. | F |
|-------------------|--------------|-------------|-----------|-------------|-----------|-------------|----------|
| Manchester | England | 7·5 | —62 | 10·6 | —56 | 122 | S. |
| Paris..... | France | 6·4 | —58 | 9·6 | —53 | 118 | S.S.E. |
| Hamburg | Germany.... | 5·6 | —53 | 8·0 | —51 | 26 | N.W.byW. |
| Lindenberg.... | „ | 6·6 | —56 | 10·8 | —49 | 28 | N.W.byW. |
| Strassburg | „ | 5·6 | —53 | 8·6 | —51 | 31 | S.E. |
| Pavia..... | Italy..... | 6·2 | —56 | 8·2 | —51 | 57 | S.E. |
| Nizhni Olchedaëff | Russia..... | 6·0 | —47 | 10·4 | —47 | 58 | E.N.E. |

An extensive anticyclone lay to the west of Europe, and a low pressure area over South Russia. Unlike the data of June 2nd, there is a uniformity of temperature, but considerable irregularity about the commencement of the isothermal column.

- 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.

RAINFALL TABLE FOR JANUARY, 1913.

| STATION. | COUNTY. | Lat. N. | Long. W. [*E.] | Height above Sea. ft. | RAINFALL OF MONTH. | |
|--------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------------------------|--------------|
| | | | | | Aver. 1875— 1909. in. | 1913. in. |
| Camden Square..... | London..... | 51 32 | 0 8 | 111 | 1·83 | 2·57 |
| Tenterden..... | Kent..... | 51 4 | *0 41 | 190 | 2·14 | 4·58 |
| Arundel (Patching)..... | Sussex..... | 50 51 | 0 27 | 130 | 2·59 | ... |
| Fawley (Cadland)..... | Hampshire..... | 50 50 | 1 22 | 52 | 2·75 | ... |
| Oxford (Magdalen College)..... | Oxfordshire..... | 51 45 | 1 15 | 186 | 1·78 | 2·61 |
| Wellingborough (Croyland Abbey)..... | Northampton..... | 52 18 | 0 41 | 174 | 1·89 | 3·14 |
| Shoeburyness..... | Essex..... | 51 31 | *0 48 | 13 | 1·33 | 2·08 |
| Bury St. Edmunds (Westley)..... | Suffolk..... | 52 15 | *0 40 | 226 | 1·70 | 2·58 |
| Geldeston [Beccles]..... | Norfolk..... | 52 27 | *1 31 | 38 | 1·53 | 2·63 |
| Polapit Tamar [Launceston]..... | Devon..... | 50 40 | 4 22 | 315 | 3·59 | 7·21 |
| Rousdon [Lyme Regis]..... | „..... | 50 41 | 3 0 | 516 | 2·94 | 6·87 |
| Stroud (Upfield)..... | Gloucestershire..... | 51 44 | 2 13 | 226 | 2·33 | 4·98 |
| Church Stretton (Wolstaston)..... | Shropshire..... | 52 35 | 2 48 | 800 | 2·51 | 3·77 |
| Coventry (Kingswood)..... | Warwickshire..... | 52 24 | 1 30 | 340 | 2·22 | 4·10 |
| Boston..... | Lincolnshire..... | 52 58 | 0 1 | 11 | 1·54 | 2·79 |
| Worksop (Hodsock Priory)..... | Nottinghamshire..... | 53 22 | 1 5 | 56 | 1·70 | 2·95 |
| Macclesfield..... | Cheshire..... | 53 15 | 2 7 | 501 | 2·66 | 3·39 |
| Southport (Hesketh Park)..... | Lancashire..... | 53 38 | 2 59 | 38 | 2·55 | 3·80 |
| Arncliffe Vicarage..... | Yorkshire, W.R..... | 54 8 | 2 6 | 732 | 6·26 | 8·53 |
| Wetherby (Ribston Hall)..... | „..... | 53 59 | 1 24 | 130 | 1·89 | 2·36 |
| Hull (Pearson Park)..... | „ E.R..... | 53 45 | 0 20 | 6 | 1·70 | 3·77 |
| Newcastle (Town Moor)..... | Northumberland..... | 54 59 | 1 38 | 201 | 1·90 | 5·44 |
| Borrowdale (Seathwaite)..... | Cumberland..... | 54 30 | 3 10 | 423 | 13·44 | 15·68 |
| Cardiff (Ely)..... | Glamorgan..... | 51 29 | 3 13 | 53 | 3·65 | 7·76 |
| Haverfordwest..... | Pembroke..... | 51 48 | 4 58 | 90 | 4·69 | 7·91 |
| Aberystwyth (Gogerddan)..... | Cardigan..... | 52 26 | 4 1 | 83 | 3·91 | 6·78 |
| Llandudno..... | Carnarvon..... | 53 20 | 3 50 | 72 | 2·51 | 3·62 |
| Cargen [Dumfries]..... | Kirkcudbright..... | 55 2 | 3 37 | 80 | 4·10 | 6·19 |
| Marchmont House..... | Berwick..... | 55 44 | 2 24 | 498 | 2·40 | 3·11 |
| Girvan (Pinmore)..... | Ayr..... | 55 10 | 4 49 | 207 | 4·78 | 6·12 |
| Glasgow (Queen's Park)..... | Renfrew..... | 55 53 | 4 18 | 144 | 3·53 | 3·14 |
| Inveraray (Newtown)..... | Argyll..... | 56 14 | 5 4 | 17 | 7·34 | 5·52 |
| Mull (Quinish)..... | „..... | 56 34 | 6 13 | 35 | 5·55 | 6·21 |
| Dundee (Eastern Necropolis)..... | Forfar..... | 56 28 | 2 57 | 199 | 2·01 | 3·43 |
| Braemar..... | Aberdeen..... | 57 0 | 3 24 | 1114 | 2·92 | 4·68 |
| Aberdeen (Cranford)..... | „..... | 57 8 | 2 7 | 120 | 2·36 | 3·19 |
| Cawdor..... | Nairn..... | 57 31 | 3 57 | 250 | 2·28 | 47 |
| Fort Augustus (S. Benedict's)..... | E. Inverness..... | 57 9 | 4 41 | 68 | 5·58 | 3·05 |
| Loch Torridon (Bendamph)..... | W. Ross..... | 57 32 | 5 32 | 20 | 9·42 | 7·65 |
| Dunrobin Castle..... | Sutherland..... | 57 59 | 3 56 | 14 | 2·75 | 48 |
| Wick..... | Caithness..... | 58 26 | 3 6 | 77 | 2·48 | 1·32 |
| Killarney (District Asylum)..... | Kerry..... | 52 4 | 9 31 | 178 | 5·94 | 9·29 |
| Waterford (Brook Lodge)..... | Waterford..... | 52 15 | 7 7 | 104 | 3·78 | 7·23 |
| Nenagh (Castle Lough)..... | Tipperary..... | 52 54 | 8 24 | 120 | 3·88 | 5·96 |
| Ennistymon House..... | Clare..... | 52 57 | 9 18 | 37 | 4·30 | 6·44 |
| Gorey (Courtown House)..... | Wexford..... | 52 40 | 6 13 | 80 | 3·19 | 7·50 |
| Abbey Leix (Blandsfort)..... | Queen's County..... | 52 56 | 7 17 | 532 | 3·15 | 7·03 |
| Dublin (Fitz William Square)..... | Dublin..... | 53 21 | 6 14 | 54 | 2·14 | 5·58 |
| Mullingar (Belvedere)..... | Westmeath..... | 53 29 | 7 22 | 367 | 3·10 | 6·58 |
| Crossmolina (Enniscooe)..... | Mayo..... | 54 4 | 9 16 | 74 | 5·35 | 8·11 |
| Cong (The Glebe)..... | „..... | 53 33 | 9 16 | 112 | 4·79 | 7·99 |
| Collooney (Markree Obsy.)..... | Sligo..... | 54 11 | 8 27 | 127 | 3·87 | 6·88 |
| Seaforde..... | Down..... | 54 19 | 5 50 | 180 | 3·41 | 6·55 |
| Bushmills (Dundarave)..... | Antrim..... | 55 12 | 6 30 | 162 | 3·19 | 2·45 |
| Omagh (Edenfel)..... | Tyrone..... | 54 36 | 7 18 | 280 | 3·46 | 5·57 |

RAINFALL TABLE FOR JANUARY, 1913—continued.

| RAINFALL OF MONTH (con.) | | | | | RAINFALL FROM JAN. 1. | | | | Mean Annual 1875—1909, in. | STATION. |
|--------------------------|----------|-------------------|-------|-------------|-----------------------|-----------|----------------------|----------|----------------------------|-----------------|
| Diff. from Av. in. | % of Av. | Max. in 24 hours. | | No. of Days | Aver. 1875—1909, in. | 1913, in. | Diff. from Aver. in. | % of Av. | | |
| | | in. | Date. | | | | | | | |
| + .74 | 140 | .50 | 11 | 17 | ... | ... | ... | ... | 25.11 | Camden Square |
| +2.44 | 214 | .77 | 13 | 21 | ... | ... | ... | ... | 27.64 | Tenterden |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | 30.48 | Patching |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | 31.87 | Cadland |
| + .83 | 146 | .67 | 19 | 18 | ... | ... | ... | ... | 24.58 | Oxford |
| +1.25 | 166 | 1.10 | 11 | 18 | ... | ... | ... | ... | 25.17 | Croyland Abbey |
| + .75 | 156 | .37 | 11 | 19 | ... | ... | ... | ... | 19.28 | Shoeburyness |
| + .88 | 152 | .64 | 11 | 18 | ... | ... | ... | ... | 25.40 | Westley |
| +1.10 | 172 | .47 | 29 | 21 | ... | ... | ... | ... | 23.73 | Geldeston |
| +3.62 | 201 | .99 | 4 | 29 | ... | ... | ... | ... | 38.27 | Polapit Tamar |
| +3.93 | 233 | .90 | 4 | 24 | ... | ... | ... | ... | 33.54 | Rousdon |
| +2.65 | 213 | 1.10 | 4 | 24 | ... | ... | ... | ... | 29.81 | Stroud |
| +1.26 | 150 | .66 | 4 | 23 | ... | ... | ... | ... | 32.41 | Wolstaston |
| +1.88 | 184 | .89 | 10 | 18 | ... | ... | ... | ... | 28.98 | Coventry |
| +1.25 | 181 | .78 | 11 | 19 | ... | ... | ... | ... | 23.35 | Boston |
| +1.25 | 173 | 1.07 | 11 | 19 | ... | ... | ... | ... | 24.46 | Hodsock Priory |
| + .73 | 127 | .67 | 4 | 15 | ... | ... | ... | ... | 34.73 | Macclesfield |
| +1.25 | 149 | .66 | 11 | 21 | ... | ... | ... | ... | 32.70 | Southport |
| +2.27 | 136 | 1.61 | 30 | 23 | ... | ... | ... | ... | 61.49 | Arneliffe |
| + .47 | 125 | .50 | 5 | 15 | ... | ... | ... | ... | 26.87 | Ribston Hall |
| +2.07 | 221 | .98 | 11 | 21 | ... | ... | ... | ... | 26.42 | Hull |
| +3.54 | 286 | 1.77 | 11 | 20 | ... | ... | ... | ... | 27.94 | Newcastle |
| +2.24 | 117 | 2.11 | 24 | 22 | ... | ... | ... | ... | 129.48 | Seathwaite |
| +4.11 | 213 | 1.29 | 4 | 28 | ... | ... | ... | ... | 42.28 | Cardiff |
| +3.22 | 169 | .99 | 22 | 28 | ... | ... | ... | ... | 46.81 | Haverfordwest |
| +2.87 | 173 | 1.15 | 22 | 23 | ... | ... | ... | ... | 45.46 | Gogerddan |
| +1.11 | 144 | .71 | 11 | 21 | ... | ... | ... | ... | 30.36 | Llandudno |
| +2.09 | 151 | 1.00 | 11 | 19 | ... | ... | ... | ... | 43.47 | Cargen |
| + .71 | 130 | .66 | 12 | 17 | ... | ... | ... | ... | 33.76 | Marchmont |
| +1.34 | 128 | 1.09 | 30 | 22 | ... | ... | ... | ... | 49.77 | Girvan |
| — .39 | 89 | .67 | 30 | 20 | ... | ... | ... | ... | 35.97 | Glasgow |
| —1.82 | 75 | 1.17 | 30 | 22 | ... | ... | ... | ... | 68.67 | Inveraray |
| + .66 | 112 | 1.01 | 30 | 21 | ... | ... | ... | ... | 56.57 | Quinish |
| +1.42 | 170 | .46 | 12 | 19 | ... | ... | ... | ... | 28.64 | Dundee |
| +1.76 | 160 | .64 | 30 | 21 | ... | ... | ... | ... | 34.93 | Braemar |
| + .83 | 135 | .61 | 28 | 18 | ... | ... | ... | ... | 32.73 | Aberdeen |
| —1.81 | 21 | .25 | 25 | 4 | ... | ... | ... | ... | 29.33 | Cawdor |
| —2.53 | 55 | .82 | 30 | 18 | ... | ... | ... | ... | 44.53 | Fort Augustus |
| —1.77 | 81 | 1.28 | 4 | 14 | ... | ... | ... | ... | 83.93 | Bendamph |
| —2.27 | 18 | .14 | 24 | 5 | ... | ... | ... | ... | 31.90 | Dunrobin Castle |
| —1.16 | 53 | .25 | 30 | 15 | ... | ... | ... | ... | 29.88 | Wick |
| +3.35 | 156 | .85 | 2, 14 | 29 | ... | ... | ... | ... | 54.81 | Killarney |
| +3.45 | 191 | 1.13 | 27 | 25 | ... | ... | ... | ... | 39.57 | Waterford |
| +2.08 | 154 | .96 | 9 | 27 | ... | ... | ... | ... | 39.43 | Castle Lough |
| +2.14 | 150 | .82 | 9 | 29 | ... | ... | ... | ... | 46.52 | Ennistymon |
| +4.31 | 235 | 1.31 | 10 | 24 | ... | ... | ... | ... | 34.99 | Courtown Ho. |
| +3.88 | 223 | 1.23 | 9 | 26 | ... | ... | ... | ... | 35.92 | Abbey Leix |
| +3.44 | 260 | 1.52 | 10 | 21 | ... | ... | ... | ... | 27.68 | Dublin |
| +3.48 | 212 | .95 | 9 | 22 | ... | ... | ... | ... | 36.15 | Mullingar. |
| +2.76 | 152 | .91 | 23 | 28 | ... | ... | ... | ... | 52.87 | Enniscoe |
| +3.20 | 167 | .82 | 23 | 29 | ... | ... | ... | ... | 48.90 | Cong |
| +3.01 | 178 | 1.40 | 9 | 23 | ... | ... | ... | ... | 42.71 | Markree |
| +3.14 | 192 | 1.16 | 11 | 24 | ... | ... | ... | ... | 38.91 | Seaforde |
| — .74 | 77 | .52 | 23 | 21 | ... | ... | ... | ... | 37.56 | Dundarave |
| +2.11 | 161 | .70 | 22 | 22 | ... | ... | ... | ... | 39.38 | Omagh |

SUPPLEMENTARY RAINFALL, JANUARY, 1913.

| Div. | STATION. | Rain inches | Div. | STATION. | Rain inches. |
|-------|-------------------------------|----------------|--------|-------------------------------|-----------------|
| II. | Warlingham, Redvers Road.. | 4·64 | XI. | Lligwy | 4·01 |
| „ | Ramsgate | 2·74 | „ | Douglas | 4·64 |
| „ | Hailsham | 4·71 | XII. | Stoneykirk, Ardwell House... | 4·31 |
| „ | Totland Bay, Aston House... | 4·65 | „ | Dalry, The Old Garroch..... | 3·39 |
| „ | Stockbridge, Ashley.. | 4·66 | „ | Beattock, Kinnelhead | 5·05 |
| „ | Grayshott | 5·57 | „ | Langholm, Drove Road | 5·43 |
| „ | Caversham, Rectory Road ... | 3·26 | XIII. | Meggat Water, Cramilt Lodge | 6·40 |
| III. | Harrow Weald, Hill House... | 2·70 | „ | North Berwick Reservoir..... | 1·93 |
| „ | Pitsford, Sedgebrook..... | 3·51 | „ | Edinburgh, Royal Observaty. | 2·28 |
| „ | Woburn, Milton Bryant..... | 2·94 | XIV. | Maybole, Knockdon Farm ... | 2·88 |
| „ | Chatteris, The Priory..... | 2·42 | XV. | Ballachulish House | 9·35 |
| IV. | Colchester, Hill Ho., Lexden | 2·86 | „ | Campbeltown, Witchburn .. | 5·48 |
| „ | Newport, Belmont House ... | 2·76 | „ | Holy Loch, Ardnadam | 9·78 |
| „ | Ipswich, Rookwood, Copdock | 3·33 | „ | Islay, Eallabus | 6·11 |
| „ | Blakeney | 2·52 | „ | Tiree, Cornaigmore | 7·01 |
| „ | Swaffham | 3·26 | XVI. | Dollar Academy | 3·19 |
| V. | Bishops Cannings | 4·15 | „ | Balquhiddier, Stronvar..... | ... |
| „ | Winterbourne Steepleton..... | 7·41 | „ | Glenlyon, Meggernie Castle.. | 8·57 |
| „ | Ashburton, Druid House..... | 11·00 | „ | Blair Atholl | 4·82 |
| „ | Cullompton | 7·07 | „ | Coupar Angus | 6·62 |
| „ | Lynmouth, Rock House | 7·91 | „ | Montrose, Sunnyside Asylum. | 4·20 |
| „ | Okehampton, Oaklands..... | 7·93 | XVII. | Alford, Lynturk Manse | 3·84 |
| „ | Hartland Abbey..... | 6·91 | „ | Fyvie Castle | 2·86 |
| „ | Probus, Lamellyn..... | 6·31 | „ | Keith Station | 2·12 |
| „ | North Cadbury Rectory..... | 5·22 | XVIII. | Alvey Manse | 1·28 |
| VI. | Clifton, Pembroke Road..... | 5·95 | „ | Loch Quoich, Loan | 12·60 |
| „ | Ross, The Graig | 4·32 | „ | Drumnadrochit | 2·47 |
| „ | Shifnal, Hatton Grange..... | 3·41 | „ | Skye, Dunvegan | 7·40 |
| „ | Droitwich | 3·38 | „ | N. Uist, Lochmaddy | 5·41 |
| „ | Blockley, Upton Wold..... | 4·36 | „ | Glencarron Lodge | 4·47 |
| VII. | Market Overton..... | 3·13 | XIX. | Invershin | ·59 |
| „ | Market Rasen..... | 2·92 | „ | Melvich | 1·54 |
| „ | Bawtry, Hesley Hall | 2·99 | „ | Loch Stack, Ardchullin | 2·13 |
| „ | Derby, Midland Railway..... | 3·38 | XX. | Skibbereen Rectory | 8·32 |
| „ | Buxton | 4·24 | „ | Dunmanway, The Rectory .. | 11·55 |
| VIII. | Nantwich, Dorfold Hall | 3·10 | „ | Glanmire, Lota Lodge, No. 1 | 7·65 |
| „ | Chatburn, Middlewood | 4·71 | „ | Mitchelstown Castle..... | 7·89 |
| „ | Cartmel, Flookburgh | 4·78 | „ | Darrynane Abbey..... | 9·92 |
| IX. | Langsett Moor, Up. Midhope | 4·44 | „ | Clonmel, Bruce Villa | 8·52 |
| „ | Scarborough, Scalby | 4·51 | „ | Newmarket-on-Fergus.Fenloe | 6·11 |
| „ | Ingleby Greenhow | 4·50 | XXI. | Laragh, Glendalough | 14·12 |
| „ | Mickleton | 3·62 | „ | Ballycumber, Moorock Lodge | 4·11 |
| X. | Bellingham, High Green Manor | 3·56 | „ | Balbriggan, Ardgillan | 5·08 |
| „ | Ilderton, Lilburn Cottage ... | 3·36 | XXII. | Woodlawn | 6·45 |
| „ | Keswick, The Bank..... | 6·09 | „ | Westport, St. Helens ... | 7·82 |
| XI. | Llanfrecfa Grange | 8·66 | „ | Dugort, Slievemore Hotel ... | ... |
| „ | Treherbert, Tyn-y-waun | 15·34 | „ | Mohill Rectory | 6·23 |
| „ | Carmarthen, The Friary | 6·41 | XXIII. | Enniskillen, Portora..... | 6·30 |
| „ | Castle Malgwyn [Llechryd]... | 7·27 | „ | Dartrey [Cootehill] | 5·56 |
| „ | Crickhowell, Tal-y-maes | 8·50 | „ | Warrenpoint, Manor House .. | 7·06 |
| „ | New Radnor, Ednol | 4·22 | „ | Banbridge, Milltown | 2·99 |
| „ | Birmingham WW., Tyrmynydd | 8·72 | „ | Belfast, Cave Hill Road | 5·39 |
| „ | Lake Vyrnwy | 6·52 | „ | Glenarm Castle..... | 5·43 |
| „ | Llangyhanfal, Pläs Draw..... | 3·13 | „ | Londonderry, Creggan Res... | 3·11 |
| „ | Dolgelly, Bryntirion..... | 6·89 | „ | Dunfanaghy, Horn Head ... | 5·10 |
| „ | Bettws-y-Coed, Tyn-y-bryn... | 6·07 | „ | Killybegs | 6·89 |

METEOROLOGICAL NOTES ON JANUARY, 1913.

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.—Dull, showery and mild conditions prevailed throughout, with fogs on several days. Mean temp. $41^{\circ}\cdot2$ or $2^{\circ}\cdot7$ above the average. Duration of sunshine $24^{\circ}\cdot8$ hours, and of R $68^{\circ}\cdot8$ hours. Evaporation $\cdot10$ in. Shade max. $52^{\circ}\cdot3$ on 23rd; min. $27^{\circ}\cdot3$ on 13th. F 9, f 19.

TENTERDEN.—The wettest January since 1886, when $4\cdot97$ in. of R fell. Duration of sunshine $56^{\circ}\cdot0$ hours. Shade max. $51^{\circ}\cdot5$ on 23rd; min. $26^{\circ}\cdot5$ on 13th. F 5, f 14.

TOTLAND BAY.—Only once in 25 years has the R been greater in January, viz., January, 1906, when $6\cdot80$ in. was recorded, which was also the only warmer January in the same period. Duration of sunshine $52^{\circ}\cdot9$ hours. Shade max., $50^{\circ}\cdot9$ on 5th; min., $31^{\circ}\cdot0$ on 13th. F 3, f 9.

PITSFORD.—Mean temp. $38^{\circ}\cdot5$. R $1\cdot85$ in. above the average. Shade max. $49^{\circ}\cdot1$ on 7th; min. $17^{\circ}\cdot6$ on 13th. F 15.

BURY ST. EDMUNDS.—Shade max. $50^{\circ}\cdot0$ on 23rd; min. $26^{\circ}\cdot5$ on 13th and 27th. F 12.

POLAPIT TAMAR.—A sunless, mild and very wet month. A rain spell of 34 days lasted from 22nd December to 24th January. Shade max. $52^{\circ}\cdot5$ on 24th; min. $27^{\circ}\cdot1$ on 14th. F 4, f 13.

NORTH CADBURY.—The R and the number of rain days were each the highest for January in 17 years' record. Fierce S showers in afternoon of 31st. Vegetation most unhappily forward. Shade max. $52^{\circ}\cdot0$ on 5th and 23rd; min. $28^{\circ}\cdot5$ on 13th. F 5, f 15.

HODSOCK PRIORY.—An unsettled month with a good deal of S, but not much hard frost. Only once has there been less sunshine in January, viz., in 1885. Shade max. $52^{\circ}\cdot0$ on 23rd; min. $12^{\circ}\cdot6$ on 14th. F 16, f 19.

SOUTHPORT.—Duration of sunshine $35^{\circ}\cdot0$ hours, and of R $102^{\circ}\cdot3$ hours. Evaporation $\cdot26$ in. S.E. winds were more prevalent than in any previous January in 42 years' record. Mean temp. $39^{\circ}\cdot1$. Shade max. $52^{\circ}\cdot0$ on 7th; min. $23^{\circ}\cdot0$ on 14th. F 9, f 16.

HULL.—Dull and gloomy, with much cloud, persistent R, and mild generally. Stormy with S on 11th. Duration of sunshine only $3^{\circ}\cdot7$ hours. Shade max. $51^{\circ}\cdot0$ on 7th; min. $26^{\circ}\cdot0$ on 13th. F 8, f 16.

LILBURN COTTAGE.—Heavy S on 11th and 12th, about 15 inches deep, but no drift.

HAVERFORDWEST.—Very mild, wet and stormy. Duration of sunshine $42^{\circ}\cdot6$ hours. Shade max. $63^{\circ}\cdot0$ on 7th; min. $26^{\circ}\cdot7$ on 14th.

LLANDUDNO.—Shade max. $54^{\circ}\cdot0$ on 7th; min. $30^{\circ}\cdot0$ on 14th and 26th.

CARGEN.—Constant and rapid fluctuations of bar. and ther. S 12 inches deep on 11th, with drifts 6 to 7 feet deep; traffic on road and railway seriously interfered with. Shade max. $51^{\circ}\cdot0$ on 7th; min. $13^{\circ}\cdot0$ on 14th. F 16.

MARCHMONT.—Duration of sunshine $20^{\circ}\cdot8$ hours. Shade max. $51^{\circ}\cdot0$ on 7th and 8th; min. $15^{\circ}\cdot0$ on 14th. F 19, 21.

INVERARAY.—S on 11th, which, though slight in the town, was heavy in the glens a few miles distant, and owing to deep drifts, the mails were stopped.

COUPAR ANGUS.—But for the soft condition of the S, all railway traffic would have been stopped for weeks. Farm work very late and little prospect of improvement.

DRUMNADROCHIT.—R $1\cdot20$ in. and rain days 8 below the average. S $7\frac{1}{2}$ inches deep on 31st, being the heaviest fall here for some years.

LOCH STACK.—Duration of sunshine $31^{\circ}\cdot5$ hours.

WATERFORD.—The wettest January since 1873. Shade max. $52^{\circ}\cdot5$ on 7th; min. $24^{\circ}\cdot0$ on 26th. F 13.

DUBLIN.—Open, stormy and wet. Only in 1895 was the R of January greater. Mean temp. $43^{\circ}\cdot4$. Wind chiefly S.E., S., or S.W. Shade max. $55^{\circ}\cdot4$ on 7th; min. $28^{\circ}\cdot1$ on 13th. F 2, f 12.

MARKREE.—Very wet, with frequent storms. Duration of sunshine $33^{\circ}\cdot1$ hours.

Climatological Table for the British Empire, August, 1912.

| STATIONS. (Those in italics are South of the Equator.) | Absolute. | | | | Average. | | | | Absolute. | | Total Rain | | Aver. Cloud. |
|--|-----------|--------|----------|--------|----------|-------|---------------|-----------|-----------------|-------------------|------------|-------|-----------------|
| | Maximum. | | Minimum. | | Max. | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth. | Days. | |
| | Temp. | Date. | Temp. | Date. | | | | | | | | | |
| London, Camden Square | 73°·2 | 4 | 43°·1 | 28 | 66°·6 | 50°·5 | 51°·6 | 82 | 117°·7 | 41°·0 | 4·89 | 25 | 6·0 |
| Malta | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Lagos | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Cape Town | 76·7 | 6 | 38·0 | 30 | 63·5 | 48·2 | 49·2 | 78 | ... | ... | 3·52 | 13 | 5·5 |
| Durban, Natal | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Johannesburg | 76·8 | 25 | 31·1 | 31 | 66·6 | 43·9 | 37·3 | 63 | 139·0 | 30·2 | ·00 | 0 | 0·8 |
| Mauritius | 77·2 | 24 | 55·5 | 24 | 75·1 | 61·4 | 59·1 | 75 | 143·8 | 49·3 | 1·75 | 18 | 5·9 |
| Bloemfontein | 80·3 | 25 | 28·2 | 14 | 67·5 | 38·2 | 30·4 | 50 | ... | ... | ·00 | 0 | 2·1 |
| Calcutta... .. | 92·2 | 31 | 75·5 | 9 | 88·4 | 78·9 | 78·4 | 87 | ... | 74·5 | 10·95 | 19 | 8·8 |
| Bombay... .. | 87·0 | 22 | 75·4 | 25 | 84·5 | 77·4 | 76·0 | 85 | 127·3 | 72·6 | 9·70 | 29 | 8·5 |
| Madras | 102·1 | 5 | 72·1 | 21, 25 | 95·9 | 77·7 | 74·5 | 75 | 144·8 | 72·1 | 5·39 | 18 | 6·9 |
| Kodaikanal | 69·2 | 8 | 49·5 | 1 | 63·5 | 52·5 | 51·9 | 84 | 144·7 | 45·2 | 5·39 | 18 | 7·6 |
| Colombo, Ceylon | 88·1 | 7 | 75·6 | 10 | 86·2 | 78·2 | 73·5 | 75 | 153·4 | 69·6 | 1·40 | 9 | 7·0 |
| Hongkong | 91·2 | 1 | 75·7 | 26 | 86·7 | 78·3 | 75·9 | 83 | 143·6 | ... | 15·72 | 19 | 7·0 |
| Sydney | 70·3 | 23 | 42·0 | 30 | 62·6 | 48·1 | 44·8 | 73 | 121·7 | 31·1 | 1·82 | 24 | 4·5 |
| Melbourne | 71·6 | 21 | 34·5 | 31 | 59·8 | 44·6 | 42·1 | 66 | 119·6 | 30·2 | 1·66 | 14 | 6·4 |
| Adelaide | 71·1 | 20, 25 | 36·1 | 14 | 61·9 | 46·9 | 45·3 | 71 | 130·0 | 29·2 | 2·12 | 13 | 6·0 |
| Perth | 76·2 | 28 | 41·4 | 21 | 65·1 | 49·1 | 48·8 | 73 | 127·2 | 35·4 | 2·69 | 19 | 5·0 |
| Coolgardie | 84·4 | 15 | 35·2 | 2 | 68·7 | 43·2 | 39·2 | 47 | 141·6 | 31·4 | ·03 | 1 | 2·3 |
| Hobart, Tasmania | 68·9 | 21 | 34·7 | 14 | 56·4 | 41·7 | 38·3 | 63 | 120·1 | 28·1 | 1·25 | 20 | 6·5 |
| Wellington | 62·0 | 25 | 29·2 | 14 | 54·7 | 41·5 | 40·6 | 75 | 118·0 | 21·0 | 1·57 | 13 | 5·0 |
| Auckland | 60·5 | 30 | 34·0 | 13 | 56·4 | 44·0 | ... | 81 | 88·0 | 31·0 | 3·60 | 16 | 5·6 |
| Jamaica, Kingston | 95·0 | 5 | 70·9 | 13 | 90·7 | 74·0 | 70·8 | 74 | ... | ... | 1·13 | 8 | 4·0 |
| Grenada | 88·0 | sev. | 73·0 | sev. | 85·0 | 76·0 | ... | 78 | 139·0 | ... | 6·07 | 19 | 4·2 |
| Toronto | 85·0 | 14 | 42·3 | 30 | 72·3 | 55·5 | ... | ... | 143·8 | 38·0 | 3·97 | 20 | 5·4 |
| Fredericton | 83·8 | 14 | 40·0 | 17 | 69·7 | 50·4 | ... | 81 | ... | ... | 5·72 | 16 | 6·1 |
| St. John, N.B. | 74·0 | 15 | 46·0 | 31 | 65·0 | 53·3 | ... | 81 | ... | ... | 5·75 | 17 | 5·9 |
| Edmonton, Alberta | 81·2 | 21 | 36·0 | 30 | 69·4 | 50·4 | ... | 79 | 134·3 | 30·0 | 4·31 | 18 | 5·6 |
| Victoria, B.C. | 81·8 | 7 | 41·2 | 28 | 68·3 | 51·4 | ... | 76 | ... | ... | 2·26 | 8 | 4·0 |

Johannesburg.—Bright sunshine 310·2 hours.

Mauritius.—Mean temp. of air 0°·3 below, and R ·73 in. below, averages. Mean hourly velocity of wind 11·6 miles, or 1·0 miles above average.

KODAIKANAL.—Bright sunshine 124 hours.

COLOMBO.—Mean temp. of air 82°·2 or 1°·6 above, of dew point 0°·2 above, and R 2·05 in. below, averages. Mean hourly velocity of wind 8·6 miles.

HONGKONG.—Mean temp. of air 81°·8. Bright sunshine 182·1 hours. Mean hourly velocity of wind 6·9 miles.

Sydney.—Mean temp. of air 0°·5 above, and R 1·45 in. below, averages.

Melbourne.—Mean temp. of air 1°·2 above, and R ·15 in. below, averages.

Adelaide.—Mean temp. of air 0°·6 above, and R ·23 in. below, averages.

Coolgardie.—Mean temp. of air 2°·7 above average.

Hobart.—Mean temp. of air 1°·0 above, and R ·57 in. below, averages.

Wellington.—Mean temp. of air 0°·3, and R 3·18 in., below averages. Bright sunshine 168·5 hours.

Auckland.—Mean temp. of air 2°·4 below average.

EDMONTON.—A damp wet month. TSS on 7 and fog on 3 days.

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VOL. XLVIII.

THE DISASTER IN THE ANTARCTIC.

UNTIL now it has been the unique distinction of Antarctic exploration that though each expedition from the time of Captain James Cook onward ran risks which made success a marvel there had been no crushing disaster to record. The public naturally enough failed in the face of repeated escapes and triumphs to realize how fine is the hair that separates life and death in the Southern, as well as in the Northern, Polar regions; and though the explorers themselves can never have failed to realize the razor-edge of the bridge they crossed to fame, their friends, we fear, have too often assumed success as a result to be commanded as surely as it was deserved. Thus, the triumphant return of Captain Scott from his second expedition to the Antarctic regions was looked for with a confidence which has bitterly aggravated the terrible news that he and his surviving companions, after having reached the South Pole, had perished in a blizzard on their return within eleven miles of safety.

We write at a distance from home and in possession only of the bare fact of the tragedy so that we cannot picture in our mind the circumstances we deplore so deeply. It is clear only that Captain R. F. Scott with Dr. E. A. Wilson and their old associate of the *Discovery* expedition Petty Officer Evans, together with Captain Oates and Lieutenant Bowers, reached the South Pole on January 18th, 1912, found the Norwegian flag flying there and returned towards their winter quarters in Macmurdo Sound. Two of the party died on the way, Captain Scott, Dr. Wilson and Lieutenant Bowers perished in a blizzard about March 29th, 1912. The journey had been unfortunate in the failure of the transport animals, but the superb endurance of the explorers overcame all difficulties up to the last stage of the return when exhausted by fatigue and, we fear, by want also, they succumbed to the overmastering force of the snow-laden gale. In a journey which taxed the whole strength merely to accomplish it there was no reasonable prospect of being able to devote sufficient time to any branch of scientific study, the results of which might in the large outlook of history compensate for the loss of such lives. No doubt much work in meteorology and geology, at least,

has been accomplished by the expedition as a whole, and this will be well worth the material cost involved. The world cannot fail to appreciate to the full the unswerving courage and determination which drove the gallant band through the increasing resistance they had to encounter on their march, and we know the spirit of Captain Scott too well to suppose that he would ever dream of endeavouring to secure his own safety unless he could carry all his surviving companions with him. It is enough to remember the awful march of ten years before when Scott and Wilson between them helped back their stricken comrade Shackleton, when the delay to their progress might have brought to all three the very same fate which has now overtaken two of them. And although the scientific value of the expedition may not have been worth this sacrifice of human life no one who looks from the higher standpoint can deny that the moral worth of this supreme example of comradeship may not be rated even so high.

We knew Captain Scott and Dr. Wilson during the preparations for their first expedition in the *Discovery*, and we were shipmate with them for ten memorable days at the outset of that voyage, and although the press of different duties gave few later opportunities of meeting, the impression made at that time is ineffaceable. Captain Scott was a sailor of the type which forms the glory of the British navy, ready for any service required of him, sympathetic with all interests, and gifted with a singular rapidity of comprehension of new facts which enabled him to become proficient in all the special studies of his scientific staff. He won great and richly deserved honour by his first expedition, and as the pioneer of Antarctic land travel he linked his name indissolubly with the continent to the centre of which he ultimately penetrated. He did not fear his fate too much, and his deserts were not small, and when he put it to the touch in his last effort he was well aware of the nearly equal balance of the chance of winning or of losing. We are sure that he met death with as calm a mind as any hero of times past, and his name will always be had in honour.

Dr. Wilson was a naturalist and artist of quite exceptional ability, and his position as chief of the scientific staff of the recent expedition was a guarantee that work of a high order would be done. We look with confidence to the results of the scientific studies of the staff of the expedition, and especially to that of Dr. G. C. Simpson on meteorology in the first year, to justify the labours and mitigate the sadness which must always hang over an enterprise which has cost so much in human suffering and life.

World-wide sympathy has sprung into expression for the relatives and friends of those who fell; and we are sure that our readers will feel with us in adding a heartfelt note to the cry of sorrow and the prayer for solace.

SOME OBSERVATIONS AND REFLECTIONS UPON THE WEATHER.

By L. C. W. BONACINA.

THE remarks I shall make in this paper are mainly derived from a close study of British weather from year to year through personal experience, Meteorological Office weather reports and the newspaper press, and though the method may lack the precision of statistical investigation it enables one to form some sound generalizations upon the subject of climate.

The commencement of the century, now a decade old, saw the accession of Dr. Shaw to the directorship of the British Meteorological Office, and of Dr. Mill to that of the British Rainfall Organization, and the researches of both these investigators have brought to light many new facts concerning the physics and sequence of daily weather on the one hand, and of the distribution and practical consequences of rainfall on the other—facts which have led us to modify or altogether discard some of the old stereotyped generalisations that had crept into the text-books. To take a simple illustration:—at one time meteorologists were always giving out that an anticyclone brought clear skies and brilliant sunshine. But any casual observer with the least experience of our British weather must surely know that as a rule anticyclonic weather brings nothing of the kind, that in our moisture-laden atmosphere only about one high-pressure system in three or four is marked by conditions in any way ideal for radiation day and night.

As a matter of fact, more anticyclones than not occasion dull and frequently gloomy weather even in summer, and give rise to the tamest and most monotonous state of the atmosphere we are liable to experience in these islands. In London there is usually so much cloud overhead in a typical winter anticyclone as to preclude the formation of dense surface fogs by radiation. Owing to clouded skies and the infrequency of complete stagnation of the atmosphere dense and dangerous surface fogs are, contrary to popular opinion, comparatively rare in London, although mist, light fogs, and overhead gloom are almost constant in the winter months. Apart, however, from the particular questions of anticyclones, recent knowledge tends to show that quite different states of weather may be associated with a similar distribution of pressure. This is often brought out instructively in the variations of seasonal rainfall, which may depend as much upon variations in the absolute humidity of the atmosphere, as upon the prevalence or absence of rain-bearing depressions. Thus, in the summer of 1911 even the cyclones ran dry or nearly so, whilst in the following December they seemed overcharged with moisture. Dr. Shaw shows us in his admirable book on Forecasting Weather, that it is after all the currents of air that really matter in the physical processes of weather, rather than the centres of high and low pressure associated with them. For a long time after the birth

of isobaric charts, we had been living, so to speak, under the tyranny of cyclones and anticyclones, holding very rigid stereotyped notions concerning the weather appropriate to each; but now we are reverting on more scientific grounds to the old way of looking at things, regarding air currents as the primary realities just as our ancestors, blissfully ignorant of the existence of curved isobars, did. In an anticyclone, for instance, the air flows outwards from the centre only to a very limited extent, and the system should be regarded more as an inert lump of air taking little part in the general circulation but directing air currents along its flanks. That this is so may be inferred from a strong piece of circumstantial evidence, apart from any dynamical reasoning. It is usually found, for instance, that in winter a north-easterly current along the southern flank of an anticyclone stationed over Britain is colder than a south-westerly current along the northern, the south of England being on such occasions colder than the north of Scotland, which would not be the case if the two currents originated in the centre of the system and diverged radially outwards. These considerations lead us on to wind direction, which always seems to bring definite characteristic temperature conditions—should the currents be in any sense long-distance ones. Thus, in the British Isles south and south-west winds are warm in winter, south also very warm in summer, north-east and east winds are bitterly cold in winter, but east hot in summer; north, north-west and even west winds are cold all the year round, while south-east is always hot in summer and frequently cold in winter. A point frequently overlooked is that the north-west wind, which in point of frequency comes third after the south-west and west respectively, is taking the year through our coldest wind in the British Islands, and it is this wind which is so liable to snow up Scotland with extreme cold for several days, as just recently at the end of November, 1912.

And this brings us to consider the peculiarities of frost and snow in the British Islands. Owing to the proximity of the Atlantic to the south-west, the high surface temperature of which prevents the prevalent south-westerly winds from cooling to the neighbourhood of the freezing point, the snowfall of the kingdom as a whole is uncertain and irregular, and dependent mainly on currents of air, direct or deflected, from the northern half of the compass; but the latitude being high, the country is peculiarly liable, with its bleak, stormy climate, to experience over many months of the year heavy snowstorms, probably of a severer character than occur normally in more continental countries like Germany or Russia, where the snowfall is more regular, the cold greater, and the weather drier and more stable. Every winter we read at intervals of deep snows in Scotland and the north and midlands of England, but somehow or other these snowstorms usually fall short of the southern counties, which often get instead weather of an atrociously damp and dismal character. Times innumerable in London when one would expect snow the approach of

moisture, even with the wind still in a cold quarter, seems to be associated with so great a liberation of the latent heat of condensation that the temperature rises to somewhere near 40° , with the consequence that a cold rain falls in place of snow.

Of course it sometimes happens that an easterly draught from the continent, associated with a depression moving up channel, will confine a blizzard to the south of England, and a most interesting peculiarity of the counties south of the Thames with respect to snow is the liability to heavy falls in spring (February, March, and April) rather than in winter (November, December, and January). During the last half century the two great blizzards of the south of England which did not affect the north were January, 1881, and March, 1891. The latter storm, which raged between the 9th and 12th of March, 1891, was exceptionally severe only in the four south-western counties, Somerset, Dorset, Devon, and Cornwall, and, oddly enough, was one of the very worst snowstorms that has ever raged in Britain. West-countrymen never tire of telling one about it to this day. An account of the storm appeared in this magazine, and there are numerous fragmentary records of the destruction wrought, but the finest description extant is that afforded by Baring Gould in his "Dartmoor Idylls," which brings out in an unrivalled manner the characteristic genius of the British moorlands in time of snow, whether in Devon, Cumberland, or Inverness.

Now for a few reflections on the intensity of frost in different parts of the country. Apart from the elevated region of the Scottish Highlands, where the conditions are naturally very severe, a study of Buchan's isothermal lines for January would appear to show that, level for level, England, is on the whole, colder in that month than Scotland. Yet general experience, year by year, shows that in the south of England we rarely experience anything like the snaps of severe frost that occur, for instance, not only in the north-east of Scotland but even in those western regions which in certain other conditions are often very mild. To quote a typical instance of recent occurrence:—on the 30th of November there was something like 40° of frost in parts of Scotland, and even in the Hebrides the cold was severe. My own experience, year by year, is that the temperature falls below 20° at west-coast stations like Stornoway and Oban much more often than it does in London. There is only one part of England—the east central district around Nottinghamshire—which gets frosts comparable in intensity with those experienced in such parts of Scotland as Aberdeen or Nairn, and this, according to Buchan's charts, has a mean air temperature of 36° in January, the lowest at sea-level in the kingdom.

The explanation of the discrepancy apparent in the fact that Scotland with, on the whole, a somewhat higher mean January temperature than England, level for level, yet on the whole suffers more from intense frost, seem to be this:—Scotland, lying farther towards the North Atlantic low pressure region, experiences even

greater instability of weather, and more rapid changes, than England, and if the cold spells do hit, as one would expect, the northern country more severely, the warm spells in winter are also rather more marked than in England as a whole, so that the resulting mean temperature may be somewhat higher. For instance, the thermometer in London hardly ever exceeds 55° in December or January, but at Aberdeen, which gets incomparably more rigorous frosts, occasions when it reaches 59° or 60° are not uncommon.

Similarly in Iceland, which lies in the zone of maximum Atlantic instability of weather, occurrences of 60° in January are still more common than in Scotland, and these are invariably followed by temperatures below zero two or three days later, but the mean temperature is not so low, for well-known reasons, as the latitude near the Arctic circle would lead one to expect.

A few remarks now about the estimation of climate. Fallacies often originate through the consideration of only one among the various important elements that go to make up climate. For instance, the mildness as regards mean temperature of the winter in England is more than counterbalanced by the ugly hygrometric condition, the sunlessness, windiness, and rapid fluctuations of temperature between warmth and severe frost, with the net result that the winter in Britain is probably more truly severe, from the physiological point of view, than it is in some Continental countries where a much greater average degree of cold is mitigated by a calm, dry, and frequently bright atmosphere, and a more stable type of weather. The wet and stormy month of December, 1911, was dubbed "mild" by the official reports, because there was no frost, but with morning after morning in London dawning black and wild, with furious squalls of wind and heavy rain chilling pedestrians through and through, a more trying type of mid-winter month could hardly be endured. I often think that the damp, dismal or stormy Decembers bring out in another way the true meaning of winter as much as the cold ones, inasmuch as snow, by its light-reflecting properties, does much to dispel the gloom of winter, whether by night or day. At any rate, in England, at least in the south (for in the north of England "white" Christmases are fairly common), we see many more "green" Christmases than "white," which shows how absurd it is to call the former "unseasonable."

METEOROLOGICAL NEWS AND NOTES.

TROPICAL RAINFALL is reported to have fallen in central Ceylon during January, and the following details of the record taken at the Friends' Mission, Clodagh, Matale, have reached us:—

"From the 1st to the 18th of January inclusive upwards of 50 inches of rain fell, the usual *annual* fall being 60 to 70 inches. The wettest day was Friday the 17th: from 8 a.m. to 6 p.m., 7·05; 6 p.m. to 10.30 p.m., 5·09; 10.30 p.m. to 8 a.m., 5·10, the total in 24 hours being 17·24 in. There were several landslips. . . . The railway train ran into a landslip; then, before it could get back, a landslip came down behind it, and it was unable to get either way."

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE "UPPER" ATMOSPHERE.

FROM the time the reports of International Balloon Ascents began to appear in *Symons's Meteorological Magazine* I have been hoping for the day to come along when samples of the atmosphere at various altitudes would be brought down for examination. The interesting letter of Mr. T. W. Backhouse in the January issue quickens this hope. It seems to me if we could find out what cosmical particles are suspended at—say—3·5 miles above sea-level, and outwards as far as possible; and how such matter seems to vary in quantity and quality from time to time, we should so obtain a key to several meteorological caprices. There should by now be no great difficulty as to the means. An exhausted vessel fitted with a valve kept in its seat by atmospheric pressure and a spiral spring could be sent up. On reaching any desired altitude the reduction of pressure should enable an inner spiral spring to lift the valve, and so allow the vessel to fill, as much as may be, at that pressure. The balloon, kept purposely captive, should then be brought down. The vessel having been automatically re-sealed by increasing pressure on the downward journey, should have the balance between inside and outside restored by the admission of air known to be clean and dry. It could then be examined for adventitious matter; and I make no doubt such examination would prove instructive.

From the time I first seriously thought over the subject until now, it has seemed to me inter-planetary space need not be so vacuous as is generally supposed. Consider the case of the earth travelling round the sun. A velocity of 18·5 miles per second seems terrific to us puny mortals, but, why miles at all?

Even at that she requires more than seven minutes to cover her equatorial diameter; and it seems to me this motion of such a body might be maintained for ages through a medium as dense as the atmosphere twenty-eight miles above sea-level without sensible diminution. Very well, then—after either a vigorous terrestrial or solar outburst the upper atmosphere or intervening space should be more or less charged with attenuated matter qualified to intercept the effect of the sun's radiation. Some of it ought to filter through to within reach of our apparatus. Since sans sun we should get no weather at all, it seems certain that any interference with his manifest radiant energy must modify meteorological phenomena.

I hope some of our enterprising investigators will carefully consider the possibilities attaching to this line of research.

WILLIAM GODDEN.

20, Richmond Avenue, Willesden, N.W., 25th January, 1913.

METEORIC STREAKS AND VELOCITIES OF UPPER AIR CURRENTS.

THE paper by Mr. J. Edmund Clark, read at the meeting of the Royal Meteorological Society on December 18th, deals with an interesting feature, and one which has only recently been seriously studied. Balloon ascents have taught us something of the atmosphere up to about 15 miles in height, but the luminous debris of meteors can carry us 40 or 50 miles higher.

During the past half century some hundreds of meteoric streaks or trains have been seen and roughly described, but very few have been fully and exactly recorded. They have persisted for intervals ranging from a few seconds to a few hours, and in many instances their contortions and rapid drifts have caused astonishment. They appear to have moved with velocities varying from 80 to 300 miles per hour, and their elevations have usually been from 65 to 50 miles. The November Leonids leave streaks from about 70 to 50 miles in height, while those of the August Perseids are a little lower, viz., 65 to 45 miles. As long ago as 1870 Prof. A. S. Herschel wrote, "The largest August meteors commonly develop a very long-enduring, phosphorescent streak about 55 miles above the level of the sea." B.A. Report, 1870, p. 86.

The streaks are mainly the outcome of the great velocity, and are only generated by the swifter class of meteors, the slower ones leave trains of sparks which are seldom very durable. There may be no special attributes of the air at elevations of 65 to 50 miles favouring the production of these glows, but it is at about this height that the swifter meteors are rendered incandescent and dissipated. The slower meteors traverse the same air strata in the earlier section of their flights, but leave no phosphorescence. Whenever they generate any lasting glow it is at a less altitude, 35 to 25 miles, for they penetrate much lower in the air than the more rapid objects. Occasionally at their final explosions and disruption they leave a luminous residue for some time, but meteors with a speed below 25 miles per second rarely, if ever, project phosphorescent streaks of the character displayed by the Leonids and Perseids.

The significant evidence afforded by the more durable meteoric phenomena alluded to, on the direction and velocity of our more lofty wind currents was recognised many years ago, but no serious effort made to extend our knowledge. The time has now come when the subject is being attentively studied, and Professor C. C. Trowbridge, of New York, is to be commended for his painstaking researches in this field.

He is collecting all available materials bearing on the subject, and it is hoped that observers generally will assist in elucidating the interesting problems involved. Large fireballs often blaze out at unexpected moments and are apt to elude regular observers.

Astronomers have, therefore, frequently to rely upon such observations as are made by casual spectators, who are usually quite incompetent to record all the necessary details. Whenever a brilliant meteor is seen its apparent path amongst the stars in the same region should be noted and its duration of flight estimated as correctly as the circumstances allow. If there is a persistent streak its direction and rate of drift should be noted by reference to stars. In the case of a person unacquainted with the constellations it will be advisable to make a diagram, at short intervals, putting the place of the streak relatively to a few bright stars in the same region, for the latter might easily be identified afterwards. Such data must prove of great value, and a wide-spread effort ought to be made to obtain it, whenever occasion offers, by scientific observers in all parts of the world.

Our lower cloud bearing layers of atmosphere show great variety at slightly different levels, and much higher still there appears to be even greater diversity. At an elevation of about 55 miles the usual velocity of meteoric afterglows seems to be about 124 miles per hour, but there are great differences in the same objects both in direction and rate of the drift. A streak lying at heights varying from say 60 to 50 miles sometimes exhibits a curiously tortuous or snake-like form under the action of widely-differing wind currents.

W. F. DENNING.

Bristol, January 22nd, 1913.

DEFINITION OF A SHOWER.

IN *Symons's Meteorological Magazine* for last December there were several interesting Meteorological queries by J.R.G.J. The first question, "What is the standard for what we call a shower," appears to be unanswerable, as there is, apparently, no standard. Walker's dictionary, published in 1831, defines a shower as "Rain, either violent or moderate," but a modern dictionary (Annandale's), gives the following definition:—"A fall of rain of short or not very great duration, also of snow or hail." This is doubtless the modern conception of a shower, but ideas may vary greatly as to what is a "short duration." My own practice is to record as a shower any downfall lasting not longer than one hour, and it would be interesting to know the practice of other rainfall observers. A recognized standard for a shower seems to be a meteorological requirement, and the British Rainfall Organization is a fitting authority to establish such a standard.

DAVID HILL OWEN.

Sparkhill, February 4th, 1913.

THE WIND INSTRUMENTS AND THE NOVEMBER HURRICANES IN JAMAICA.

By MAXWELL HALL, Government Meteorologist.

At the Negril Lighthouse, Mr. Brownhill had a Robinson anemometer which was well exposed on the lighthouse with electric wires attached, so that every mile of wind was recorded on a drum revolving by clock-work, the recording apparatus being inside his dwelling-house. By these means 80 miles an hour was registered from 10 p.m. on the 17th to 1 a.m. on the 18th November, and the instrument even registered the commencement of the violent hurricane of 120 miles an hour at 2 a.m., but the centrifugal force was now so great that a pair of the arms broke and flew away.

At Kempshot the Robinson anemometer* had no such recording apparatus, and merely measured the miles of wind in any interval of time. As soon as the wind had increased to 70 miles, with no doubt stronger gusts, the knob at the top became unscrewed and the arms and the cups flew away uninjured. The arms were pressed down by the knob-screw on to the slightly tapering cylindrical rod or axis; and the knob, arms, and rod were all thus firmly held together, but if extreme violence caused the arms to revolve round the axis, causing "slip" in the registration, the arms from their direction of motion would unscrew the knob. Up to this time the estimated miles of wind agreed with the measured miles, so that the estimated velocity of 80 miles an hour between noon and 2 p.m. may be fairly correct.

There was also a large Osler pressure-plate anemometer† on a very heavy wooden structure, 30 feet high, which stood on high ground. It had been an expensive instrument, costing in England about £80, and it had registered pressure and direction continuously in Kingston for many years; but when the service was disestablished in 1902 it was moved to Kempshot, and there it registered only the maximum pressure in any interval of time. By means of it and the Robinson the formula had been deduced of

$$v^2 = 280 P,$$

where v is the velocity of the wind in miles per hour, and P the pressure in pounds per square foot.

On this occasion as the mid-day hurricane came on, the pressure-plate was seen to be jerked back continually as far as it could go. The registering part had been arranged at Kempshot to register only 30 lbs., but I believe it could have gone back to 40 lbs.; but this was clearly not enough. However, a violent gust caught the massive vane sideways and broke it in two; the wind then took advantage of this wreckage on top of the wooden structure and hurled the whole

* Fig. 89, p. 82, of Negretti & Zambra's large catalogue of about 1880.

† Fig. 92, page 85, *minus* the rain-gauge, of Negretti & Zambra's large catalogue of about 1880.

out of the ground, although the four feet had been embedded in mason-work.

The evening hurricane was much more violent, but lasted a very short time. At the side of an exposed terrace there were a large number of cubical flower-pots placed on the grass, out of which the plants had been blown by the mid-day hurricane. These flower-pots were made out of the tins in which kerosine oil is imported, and they were full of wet soil; they were 9 inches square and $6\frac{1}{2}$ inches high, so that the diagonal of the square base was 13 inches, and they might have exposed as much as six-tenths of a foot of surface to the wind; they weighed on an average 25 lbs. These flower-pots were blown by the evening hurricane here and there; some were upside down, some were far removed from the terrace. They were subsequently replaced, and I found by means of a spring-balance that it required a force of 30 lbs. to move them from their position on the grass, and 20 lbs. to keep them moving, so that the wind must have had a greater force than 30 lbs. on six-tenths of a square foot, or a greater force than 50 lbs. on a square foot; and this would give more than 118 miles per hour according to the above formula.

I have given this account at some length, because no instrument can apparently be depended on to register a "violent" hurricane, which would be 16 on the Beaufort scale if one were permitted to enlarge that scale.

ROYAL METEOROLOGICAL SOCIETY.

AN ordinary General Meeting was held on February 19th at the Surveyors' Institution, Great George Street, Westminster, Mr. C. J. P. Cave, president, in the chair. A resolution of sympathy with the Royal Geographical Society, in the loss which they and the nation have sustained in the death of Captain R. F. Scott and his comrades in the Antarctic, was proposed by the president and seconded by Dr. W. N. Shaw, who spoke with high admiration of the splendid spirit which still lives in our race.

A paper on "Periodical Variations of the Velocity of the Wind at Oxford," by Mr. W. H. Robinson, was read in the absence of the author. The results from various anemometers in use showed the same essential features. The mean monthly velocity for 10, 27, and 30 years indicated (1) a rapid fall between March and June, (2) an equally rapid rise between September and December, (3) a minimum in September, (4) a range in the annual variation of 3 or 4 miles per hour. By means of curves a comparison was made showing correlation with temperature and atmospheric pressure. The diurnal variation taken at intervals of 2 hours showed a maximum at 1 p.m. and a minimum at 5 a.m. The comparison with the mean diurnal

inequalities of temperature indicated a marked parallelism. In both curves the falls are comparatively slow, while the rises are rapid and the times of maximum and minimum of temperature and velocity sensibly agree. The author expressed the opinion that the relation of the two curves was, with the exception of a period in the afternoon, in support of the Espy-Köppen convection theory.

Dr. Shaw said that with regard to the relation of the wind-velocity to pressure he considered that comparison should rather have been made with the pressure *gradient*. A steep gradient was generally associated with a low barometer and *vice versa*; yet January and February with high pressure had also high wind velocities. He criticised the breakdown in parallelism in the curves of temperature inequalities and wind velocity as a support and not a contradiction of the Espy-Köppen theory.

Mr. Bryant remarked on the relationship between the monthly velocity curves at Oxford and those for Greenwich, and Mr. Brodie spoke of the Kew results.

A paper on the "Rate of Ascent of Pilot Balloons," by Mr. J. S. Dines, described experiments which he had made at the Royal Aircraft Factory, Farnborough, in order to determine the rate of ascent of small pilot balloons of the type which he has used for the past two years in his work for the Advisory Committee for Aeronautics.

A paper on "Meteorological Conditions in a Field Crop with a description of two simple recorders," by Mr. W. L. Balls, was also read. A simple form of anemograph and a differential thermograph for recording clouds at night were devised by the author in an endeavour to explain the decreased yield of cotton in Egypt. The instruments showed in a remarkable manner the effect of the wind on the humidity, a fall of the wind being accompanied by a rise in the humidity which again dropped to normal when the wind resumed. The argument that these effects might be due to clouds was confuted by experiments with the differential thermograph which served the purpose of cloud recorder.

Captain Lyons expressed regret that the author did not give details of his observations in July, in which month there was usually more water near the surface of the ground, and in September when the crops are ready to be picked.

Colonel Rawson said that humidity was an all important factor in such a country as Egypt, where plants often die solely as a result of the choking effects of dust.

The following were elected Fellows of the Society :—Messrs. H. E. Carter, J. H. Hull, S. P. Scott.



INTERNATIONAL BALLOON ASCENTS.

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

August 8th, 1910.

| Starting Point. | Country. | A miles. | B ° F. | C miles | D ° F. | E miles. | F |
|-------------------|--------------|-------------|-----------|------------|-----------|-------------|------------|
| Manchester | England ... | 6·9 | —69 | 10·6 | —58 | 27 | N.W.byW. |
| Pyrtton Hill | „ ... | 7·0 | —62 | 10·0 | —56 | 13 | N.E.byN. |
| „ | „ ... | 6·8 | —71 | 11·4 | —60 | 18 | N.N.W. |
| Crinan | Scotland .. | 7·1 | —67 | 9·7 | —49 | 16 | N.N.E. |
| „ | „ .. | 7·0 | —72 | 11·3 | —58 | 27 | N. by W. |
| Brussels | Belgium .. | 7·1 | —62 | 10·6 | —67 | 38 | E.N.E. |
| Paris | France | *7·2 | —60 | 10·1 | —60 | 58 | E.N.E. |
| Hamburg | Germany .. | 6·3 | —53 | 10·4 | —63 | 48 | S.E. |
| Strassburg | „ .. | *7·8 | —65 | 8·6 | —69 | 60 | N. |
| Munich | „ .. | *6·9 | —45 | 9·5 | —62 | 58 | S.S.E. |
| Vienna | Austria | 6·4 | —53 | 11·7 | —40 | 47 | S.E. by S. |
| Pavia | Italy | *8·4 | —72 | 8·8 | —72 | 44 | E. by S. |
| Pavlovsk | Russia | 6·9 | —67 | 11·2 | —47 | 80 | W. |
| Nizhni Olchedaëff | „ | 5·6 | —49 | 7·6 | —45 | 42 | N. by E. |

August 9th, 1910.

| | | | | | | | |
|-------------------|--------------|-----|-----|------|-----|----|------------|
| Pyrtton Hill | England ... | 6·9 | —72 | 10·8 | —49 | 18 | S.W.byW. |
| Petersfield | „ ... | 6·9 | —62 | 10·6 | —49 | 20 | N. |
| Crinan | Scotland ... | 7·2 | —67 | 10·9 | —45 | 71 | N. by W. |
| Brussels | Belgium ... | 7·6 | —78 | 11·1 | —54 | 26 | E.N.E. |
| Paris | France | 7·5 | —74 | 10·5 | —56 | 43 | N.N.E. |
| Hamburg | Germany .. | 6·3 | —63 | 9·8 | —62 | 11 | S.S.E. |
| Lindenberg | „ .. | 6·8 | —60 | 9·6 | —54 | 23 | S.E. by E. |
| Strassburg | „ .. | 8·1 | —67 | 8·8 | —65 | 17 | N.E. |
| Munich | „ .. | 7·7 | —76 | 9·7 | —56 | 48 | E. |
| Ekaterinberg... | Russia | 6·1 | —62 | 9·7 | —54 | 84 | S.E. by E. |

August 10th, 1910.

| | | | | | | | |
|-------------------|--------------|-----|-----|------|-----|----|------------|
| Pyrtton Hill | England ... | 7·1 | —69 | 8·5 | ? | 55 | S. by E. |
| Brussels | Belgium ... | 7·4 | —74 | 13·6 | —72 | 22 | S. by E. |
| Paris | France | 7·2 | —71 | 10·3 | —58 | 38 | S.W.byW. |
| Lindenberg | Germany .. | 7·1 | —62 | 12·0 | ? | 27 | E.S.E. |
| Strassburg | „ .. | 6·4 | —58 | 10·6 | —56 | 26 | S.E. by S. |
| Munich | „ .. | 7·3 | —71 | 8·0 | —54 | 3 | N.W. |
| Vienna | Austria | 6·8 | —62 | 11·3 | —47 | 15 | E.N.E. |
| Pavia | Italy | 6·3 | —63 | 9·0 | —56 | 44 | N.E.byE. |
| Pavlovsk | Russia | 5·7 | —49 | 8·6 | —47 | 7 | N. by E. |

A * denotes that the value of H_c is indefinite.

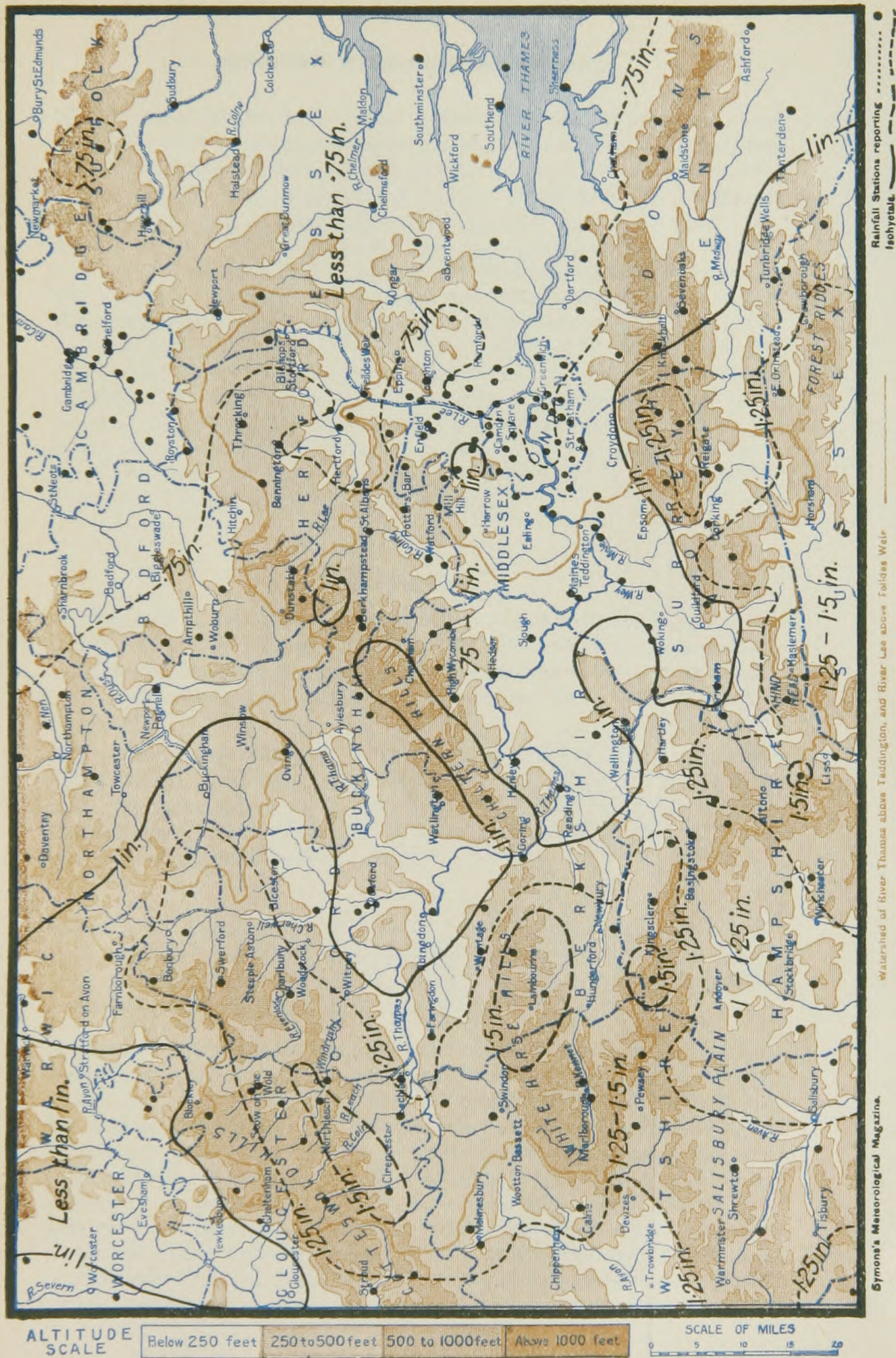
On all three days pressure was lowest to the north of the Black Sea, but quite average summer conditions prevailed over the west and mid-European stations. The only noticeable features are the discrepancies shown at Strassburg.

- 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 WEATHER OF FEBRUARY.

TEMPERATURE throughout February was generally lower than in January, but in spite of this it was slightly above the normal in most parts of the British Isles. The excess over the normal was unusually great during the first week, and amounted to more than 6° in the east and south-east of England, and to more than 4° over the greater part of the kingdom. On the 4th readings of 50° and above were recorded in most parts of England and Ireland, and 55° or 56° in London and stations in the southern and midland counties. On the 7th a very deep secondary depression moved north-eastwards over the north-western and northern districts, and occasioned a severe gale on many parts of the coast. At Southport several squalls reached a velocity of 86 miles per hour. Rain fell generally, but the amounts were not great. Temperature remained high, being above 50° at many stations and reaching 55° at Shields. Unsettled, humid conditions continued during the days following, and many stations recorded the highest temperatures of the month between the 9th and 11th. At Jersey a shade maximum temperature of 60° occurred on the 11th, and 58° was recorded in the eastern counties of England, in Wales and in the south of Ireland. Fogs were experienced in the London district each day from 11th to 15th. On the latter day an unusually heavy fog hung over the metropolis, causing unnatural darkness throughout the morning and early afternoon. Less intense fogs also occurred in many parts of the kingdom. Temperature fell during the 15th, and was below the average during the week following, the greatest divergence occurring in the south-west of England. Hardly any of the rain fell over the whole of the British Isles, and fair weather prevailed generally over England, but over Scotland and Ireland it was cloudy. An anticyclonic system lay to the north of Scotland for some days, causing bleak easterly winds over practically the whole of Great Britain. At many places the temperature never rose to 45° , and shade minima readings of 23° were recorded at West Linton, Bettws-y-Coed and Llangammarch Wells on the 22nd, Similar readings occurred further south on the 23rd, but on the 24th a decided rise of temperature took place, and maximum readings

THAMES VALLEY RAINFALL — FEBRUARY, 1913.



Symons's Meteorological Magazine.

Rainfall Stations reporting

of 50° were recorded at a few widely distributed stations. The weather was of a changeable type during the last few days, and the temperature fluctuations, though very irregular, were not remarkable.

The month was unusually dry over practically the whole of England, the east of Scotland, and the greater part of Ireland. An area in the west of Ireland had a fall approximating to the normal, and the precipitation in the west of Scotland was slightly in excess of the average. The general rainfall over the great divisions of the Kingdom expressed as a percentage of the average was as follows:—England and Wales, 52: Scotland, 77: Ireland, 68: British Isles, 63.

The duration of sunshine was far below the average at many stations, and only at a few places was it exceeded. The total recorded at Camden Square, London, was 44 hours, and at Kew 37 hours were recorded. Nottingham had 41 hours, Bath 71 hours, Scilly 80 hours, Newquay 94 hours, and Jersey had as much as 109 hours or 17 hours in excess of the average.

REVIEWS.

Il Clima di Roma esame delle osservazioni meteorologiche eseguite dal 1782 al 1910. Studio del dottor [The Climate of Rome according to the Meteorological observations carried out from 1782 to 1910. A study by Dr.] **FILIPPO EREDIA.** Rome, 1911. Size 13½ × 9½. Pp. 102.

A COMPREHENSIVE discussion of the climate of Rome, based on nearly 130 years' observations. The work was undertaken in connection with the intended visit of the tenth International Geographical Congress to Rome in 1911, which was postponed on account of the outbreak of the war between Italy and Turkey.

Ueber das Erscheinen der Seebrise an der Schwedischen Ostküste. Inaugural-Dissertation, von [On the appearance of the sea-breeze on the east coast of Sweden. Inaugural Dissertation by] **SVEN GRENANDER.** Uppsala, 1912. Size 9½ × 6. Pp. 104.

A STUDY of the winds on the east coast of Sweden facing the Gulf of Bothnia for the months from April to September, based on the comparison of data from a number of coast and inland stations for the decade 1900-1909. The observations on many light-houses and light-ships lying well off the coast were also considered, and the assistance of a large number of voluntary observers on shore was utilized. An interesting feature connected with the winds off the east coast of Sweden is that the wind often blows from opposite directions, and a vessel running before a north wind comes abruptly to a narrow belt of calm beyond which it encounters an equally strong south wind.

RAINFALL TABLE FOR FEBRUARY, 1913.

| STATION. | COUNTY. | Lat. N. | Long. W. [°E.] | Height above Sea. ft. | RAINFALL OF MONTH. | |
|--------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------------------------|--------------|
| | | | | | Aver. 1875— 1909. in. | 1913. in. |
| Camden Square..... | London | 51 32 | 0 8 | 111 | 1'66 | '79 |
| Tenterden..... | Kent | 51 4 | *0 41 | 190 | 1'90 | '94 |
| Arundel (Patching)..... | Sussex | 50 51 | 0 27 | 130 | 2'17 | 1'59 |
| Fawley (Cadland) | Hampshire | 50 50 | 1 22 | 52 | 2'28 | 1'26 |
| Oxford (Magdalen College)..... | Oxfordshire | 51 45 | 1 15 | 186 | 1'62 | '80 |
| Wellingborough (Croyland Abbey)..... | Northampton..... | 52 18 | 0 41 | 174 | 1'69 | '72 |
| Shoeburyness..... | Essex | 51 31 | *0 48 | 13 | 1'19 | '57 |
| Bury St. Edmunds (Westley)..... | Suffolk | 52 15 | *0 40 | 226 | 1'59 | '75 |
| Geldeston [Beccles]..... | Norfolk..... | 52 27 | *1 31 | 38 | 1'41 | '68 |
| Polapit Tamar [Launceston]..... | Devon | 50 40 | 4 22 | 315 | 2'95 | 1'71 |
| Rousdon [Lyme Regis] | " | 50 41 | 3 0 | 516 | 2'50 | '93 |
| Stroud (Upfield) | Gloucestershire..... | 51 44 | 2 13 | 226 | 2'12 | 1'15 |
| Church Stretton (Wolstaston)..... | Shropshire | 52 35 | 2 48 | 800 | 2'17 | 1'34 |
| Coventry (Kingswood) | Warwickshire | 52 24 | 1 30 | 340 | 2'01 | 1'02 |
| Boston | Lincolnshire..... | 52 58 | 0 1 | 11 | 1'53 | '60 |
| Worksop (Hodsock Priory)..... | Nottinghamshire..... | 53 22 | 1 5 | 56 | 1'64 | '77 |
| Macclesfield | Cheshire | 53 15 | 2 7 | 501 | 2'30 | 1'27 |
| Southport (Hesketh Park)..... | Lancashire | 53 38 | 2 59 | 38 | 2'07 | 1'15 |
| Arncliffe Vicarage | Yorkshire, W.R. | 54 8 | 2 6 | 732 | 4'88 | 4'08 |
| Wetherby (Ribston Hall) | " | 53 59 | 1 24 | 130 | 1'71 | '91 |
| Hull (Pearson Park) | " E.R. | 53 45 | 0 20 | 6 | 1'78 | '68 |
| Newcastle (Town Moor) | Northumberland..... | 54 59 | 1 38 | 201 | 1'63 | '40 |
| Borrowdale (Seathwaite) | Cumberland..... | 54 30 | 3 10 | 423 | 10'96 | 10'53 |
| Cardiff (Ely)..... | Glamorgan | 51 29 | 3 13 | 53 | 3'07 | 1'45 |
| Haverfordwest..... | Pembroke | 51 48 | 4 58 | 90 | 3'42 | 2'46 |
| Aberystwyth (Gogerddan)..... | Cardigan | 52 26 | 4 1 | 83 | 3'09 | 1'42 |
| Llandudno | Carnarvon | 53 20 | 3 50 | 72 | 2'11 | '76 |
| Cargen [Dumtries] | Kirkcudbright..... | 55 2 | 3 37 | 80 | 3'42 | 3'02 |
| Marchmont House | Berwick | 55 44 | 2 24 | 498 | 2'15 | 1'13 |
| Girvan (Pinnmore)..... | Ayr | 55 10 | 4 49 | 207 | 3'87 | 2'21 |
| Glasgow (Queen's Park) | Renfrew | 55 53 | 4 18 | 144 | 2'70 | 3'21 |
| Inveraray (Newtown) | Argyll | 56 14 | 5 4 | 17 | 5'71 | 5'73 |
| Mull (Quinish)..... | " | 56 34 | 6 13 | 35 | 4'45 | 3'28 |
| Dundee (Eastern Necropolis)..... | Forfar | 56 28 | 2 57 | 199 | 1'91 | '66 |
| Braemar | Aberdeen | 57 0 | 3 24 | 1114 | 2'55 | 1'54 |
| Aberdeen (Cranford) | " | 57 8 | 2 7 | 120 | 2'36 | '77 |
| Cawdor | Nairn | 57 31 | 3 57 | 250 | 2'06 | 2'91 |
| Fort Augustus (S. Benedict's)..... | E. Inverness | 57 9 | 4 41 | 68 | 4'20 | 5'61 |
| Loch Torridon (Bendamph)..... | W. Ross | 57 32 | 5 32 | 20 | 7'53 | 5'54 |
| Dunrobin Castle | Sutherland | 57 59 | 3 56 | 14 | 2'58 | 1'52 |
| Wick | Caithness | 58 26 | 3 6 | 77 | 2'23 | 1'16 |
| Killarney (District Asylum)..... | Kerry | 52 4 | 9 31 | 178 | 4'99 | 3'84 |
| Waterford (Brook Lodge)..... | Waterford | 52 15 | 7 7 | 104 | 3'18 | 2'37 |
| Nenagh (Castle Lough)..... | Tipperary..... | 52 54 | 8 24 | 120 | 2'89 | 2'01 |
| Ennistymon House | Clare | 52 57 | 9 18 | 37 | 3'44 | 2'57 |
| Gorey (Courtown House) | Wexford | 52 40 | 6 13 | 80 | 2'75 | 2'05 |
| Abbey Leix (Blandsfort)..... | Queen's County..... | 52 56 | 7 17 | 532 | 2'55 | 1'64 |
| Dublin (Fitz William Square)..... | Dublin | 53 21 | 6 14 | 54 | 1'93 | '60 |
| Mullingar (Belvedere) | Westmeath | 53 29 | 7 22 | 367 | 2'67 | 1'09 |
| Crossmolina (Enniscoe)..... | Mayo..... | 54 4 | 9 16 | 74 | 4'20 | 3'93 |
| Cong (The Glebe)..... | " | 53 33 | 9 16 | 112 | 3'72 | 3'88 |
| Collooney (Markree Obsy.)..... | Sligo | 54 11 | 8 27 | 127 | 3'20 | 2'23 |
| Seaforde | Down..... | 54 19 | 5 50 | 180 | 2'81 | 1'60 |
| Bushmills (Dundarave) | Antrim | 55 12 | 6 30 | 162 | 2'56 | 1'32 |
| Omagh (Edenfel)..... | Tyrone | 54 36 | 7 18 | 280 | 2'68 | 1'87 |

RAINFALL TABLE FOR FEBRUARY, 1913—*continued.*

| RAINFALL OF MONTH (<i>con.</i>) | | | | | RAINFALL FROM JAN. 1. | | | | Mean Annual 1875-1909. in. | STATION. |
|-----------------------------------|----------|-------------------|-------|-------------|-----------------------|-----------|----------------------|----------|----------------------------|-----------------|
| Diff. from Av. in. | % of Av. | Max. in 24 hours. | | No. of Days | Aver. 1875-1909. in. | 1913. in. | Diff. from Aver. in. | % of Av. | | |
| in. | | in. | Date. | | | | | | | |
| — .87 | 48 | .25 | 1 | 12 | 3.49 | 3.36 | — .13 | 96 | 25.11 | Camden Square |
| — .96 | 49 | .33 | 1 | 10 | 4.04 | 5.52 | +1.48 | 137 | 27.64 | Tenterden |
| — .58 | 73 | .70 | 1 | 10 | 4.76 | 6.79 | +2.03 | 143 | 30.48 | Patching |
| —1.02 | 55 | .38 | 1 | 12 | 5.03 | 6.08 | +1.05 | 121 | 31.87 | Cadland |
| — .82 | 49 | .22 | 9 | 11 | 3.40 | 3.41 | + .01 | 100 | 24.58 | Oxford |
| — .97 | 43 | .26 | 9 | 9 | 3.58 | 3.86 | + .28 | 108 | 25.17 | Croyland Abbey |
| — .62 | 48 | .24 | 1 | 8 | 2.52 | 2.65 | + .13 | 105 | 19.28 | Shoeburyness |
| — .84 | 47 | .24 | 9 | 10 | 3.29 | 3.33 | + .04 | 101 | 25.40 | Westley |
| — .73 | 48 | .33 | 1 | 8 | 2.94 | 3.31 | + .37 | 113 | 23.73 | Geldeston |
| —1.24 | 58 | .57 | 7 | 10 | 6.54 | 8.92 | +2.38 | 136 | 38.27 | Polapit Tamar |
| —1.57 | 37 | .29 | 7 | 10 | 5.44 | 7.80 | +2.36 | 143 | 33.54 | Rousdon |
| — .97 | 54 | .25 | 7 | 13 | 4.45 | 6.13 | +1.68 | 138 | 29.81 | Stroud |
| — .83 | 62 | .34 | 9 | 15 | 4.68 | 5.11 | + .43 | 109 | 32.41 | Wolstaston |
| — .99 | 51 | .29 | 9 | 7 | 4.23 | 5.70 | +1.47 | 135 | 28.08 | Coventry |
| — .93 | 39 | .26 | 9 | 12 | 3.07 | 3.39 | + .32 | 110 | 23.35 | Boston |
| — .87 | 47 | .20 | 9 | 15 | 3.34 | 3.72 | + .38 | 111 | 24.46 | Hodsock Priory |
| —1.03 | 55 | .40 | 9 | 12 | 4.96 | 4.66 | — .30 | 94 | 34.73 | Macclesfield |
| — .92 | 56 | .19 | 6, 7 | 13 | 4.62 | 4.95 | + .33 | 107 | 32.70 | Southport |
| — .80 | 84 | 1.23 | 7 | 13 | 11.14 | 12.61 | +1.47 | 113 | 61.49 | Arncliffe |
| — .80 | 53 | .27 | 8 | 16 | 3.60 | 3.27 | — .33 | 91 | 26.87 | Ribston Hall |
| —1.10 | 38 | .27 | 9 | 15 | 3.48 | 4.45 | + .97 | 128 | 26.42 | Hull |
| —1.23 | 25 | .12 | 9 | 9 | 3.53 | 5.84 | +2.31 | 165 | 27.94 | Newcastle |
| — .43 | 96 | 3.25 | 3 | 15 | 24.40 | 26.21 | +1.81 | 107 | 129.48 | Seathwaite |
| —1.62 | 47 | .34 | 2 | 14 | 6.72 | 9.21 | +2.49 | 137 | 42.28 | Cardiff |
| — .96 | 72 | .55 | 9 | 10 | 8.11 | 10.37 | +2.26 | 128 | 46.81 | Haverfordwest |
| —1.67 | 46 | .33 | 9 | 10 | 7.00 | 8.20 | +1.20 | 117 | 45.46 | Gogerddan |
| —1.35 | 36 | .18 | 9 | 9 | 4.62 | 4.38 | — .24 | 95 | 30.36 | Llandudno |
| — .40 | 88 | .54 | 7 | 14 | 7.52 | 9.21 | +1.69 | 122 | 43.47 | Cargen |
| —1.02 | 53 | .18 | 10 | 16 | 4.55 | 4.24 | — .31 | 93 | 33.77 | Marchmont |
| —1.66 | 57 | .44 | 7 | 15 | 8.65 | 8.33 | — .32 | 96 | 49.77 | Girvan |
| + .51 | 119 | .76 | 3 | 14 | 6.23 | 6.35 | + .12 | 102 | 35.97 | Glasgow |
| + .02 | 100 | 1.45 | 2 | 16 | 13.05 | 11.25 | —1.80 | 86 | 68.67 | Inveraray |
| —1.17 | 74 | .53 | 4 | 14 | 10.00 | 9.49 | — .51 | 95 | 56.57 | Quinish |
| —1.25 | 35 | .09 | 6, 7 | 11 | 3.92 | 4.09 | + .17 | 104 | 28.64 | Dundee |
| —1.01 | 60 | .39 | 5 | 10 | 5.47 | 6.22 | + .75 | 114 | 34.93 | Braemar |
| —1.59 | 33 | .22 | 7 | 11 | 4.72 | 3.96 | — .76 | 84 | 32.73 | Aberdeen |
| + .85 | 141 | 1.00 | 3 | 9 | 4.34 | 3.38 | — .96 | 78 | 29.33 | Cawdor |
| +1.41 | 134 | 1.15 | 3 | 18 | 9.78 | 8.66 | +1.12 | 89 | 44.53 | Fort Augustus |
| —1.99 | 74 | 1.02 | 2 | 16 | 16.95 | 13.19 | —3.76 | 78 | 83.93 | Bendamp |
| —1.06 | 59 | .30 | 5 | 12 | 5.33 | 2.00 | —3.33 | 38 | 31.90 | Dunrobin Castle |
| —1.07 | 52 | .23 | 7 | 17 | 4.71 | 2.48 | —2.23 | 53 | 29.88 | Wick |
| —1.15 | 77 | .80 | 6 | 13 | 10.93 | 13.13 | +2.20 | 120 | 54.81 | Killarney |
| — .81 | 75 | .56 | 9 | 12 | 6.96 | 9.60 | +2.64 | 138 | 39.57 | Waterford |
| — .88 | 70 | .51 | 1 | 11 | 6.77 | 7.97 | +1.20 | 118 | 39.43 | Castle Lough |
| — .87 | 75 | .62 | 1 | 14 | 7.74 | 9.01 | +1.27 | 116 | 46.52 | Ennistymon |
| — .70 | 75 | .46 | 7 | 13 | 5.94 | 9.55 | +3.61 | 193 | 34.99 | Courtown Ho. |
| — .91 | 64 | .39 | 24 | 13 | 5.70 | 8.67 | +2.97 | 152 | 35.92 | Abbey Leix |
| —1.33 | 31 | .15 | 24 | 13 | 4.07 | 6.18 | +2.11 | 152 | 27.68 | Dublin |
| —1.58 | 41 | .19 | 7 | 11 | 5.77 | 7.67 | +1.90 | 133 | 36.15 | Mullingar |
| — .27 | 94 | .89 | 4 | 16 | 9.55 | 12.04 | +2.49 | 126 | 52.87 | Enniscoe |
| + .16 | 104 | .78 | 3 | 14 | 8.51 | 11.87 | +3.36 | 140 | 48.90 | Cong |
| — .97 | 70 | .45 | 7 | 12 | 7.07 | 9.11 | +2.04 | 129 | 42.71 | Markree |
| —1.21 | 57 | .49 | 24 | 12 | 6.22 | 8.15 | +1.93 | 131 | 38.91 | Seaforde |
| —1.24 | 52 | .32 | 7 | 12 | 5.75 | 3.77 | —1.98 | 66 | 37.56 | Dundarave |
| — .81 | 70 | .40 | 3 | 15 | 6.14 | 7.44 | +1.30 | 121 | 39.38 | Omagh |

SUPPLEMENTARY RAINFALL, FEBRUARY, 1913.

| Div. | STATION. | Rain inches | Div. | STATION. | Rain inches. |
|-------|-------------------------------|----------------|--------|-------------------------------|-----------------|
| II. | Warlingham, Redvers Road.. | 1·29 | XI. | Lligwy | 1·34 |
| „ | Ramsgate | ·69 | „ | Douglas | 1·71 |
| „ | Hailsham | 1·28 | XII. | Stoneykirk, Ardwell House... | 1·29 |
| „ | Totland Bay, Aston House... | 1·35 | „ | Dalry, The Old Garroch..... | 5·58 |
| „ | Stockbridge, Ashley..... | 1·07 | „ | Beattock, Kinnelhead | 5·60 |
| „ | Grayshott | 1·45 | „ | Langholm, Drove Road | 3·81 |
| „ | Caversham, Rectory Road ... | ·85 | XIII. | Meggat Water, Cramilt Lodge | 3·85 |
| III. | Harrow Weald, Hill House... | ·93 | „ | North Berwick Reservoir..... | ·62 |
| „ | Pitsford, Sedgebrook..... | ·77 | „ | Edinburgh, Royal Observaty. | 1·26 |
| „ | Woburn, Milton Bryant..... | ·75 | XIV. | Maybole, Knockdon Farm ... | 2·00 |
| „ | Chatteris, The Priory..... | ·70 | XV. | Ballachulish House | 9·30 |
| IV. | Colchester, Hill Ho., Lexden | ·56 | „ | Campbeltown, Witchburn .. | 2·26 |
| „ | Newport, Belmont House ... | ·56 | „ | Holy Loch, Ardnadam..... | 7·53 |
| „ | Ipswich, Rookwood, Copdock | ·51 | „ | Islay, Eallabus | 2·86 |
| „ | Blakeney | ·44 | „ | Tiree, Coraigmore | 2·95 |
| „ | Swaffham | ·68 | XVI. | Dollar Academy | 2·96 |
| V. | Bishops Cannings | 1·19 | „ | Balquhider, Stronvar..... | 6·59 |
| „ | Winterbourne Steepleton..... | 1·86 | „ | Glenlyon, Meggernie Castle.. | 7·69 |
| „ | Ashburton, Druid House..... | 3·03 | „ | Blair Atholl | 2·57 |
| „ | Cullompton | ·94 | „ | Coupar Angus | 1·13 |
| „ | Lynmouth, Rock House ... | 1·96 | „ | Montrose, Sunnyside Asylum. | ·84 |
| „ | Okehampton, Oaklands..... | 1·79 | XVII. | Alford, Lynturk Manse | ·58 |
| „ | Hartland Abbey | 1·17 | „ | Fyvie Castle | ·68 |
| „ | Probus, Lamellyn..... | 1·14 | „ | Keith Station .. | 1·06 |
| „ | North Cadbury Rectory..... | 1·03 | XVIII. | Alvey Manse..... | 2·36 |
| VI. | Clifton, Pembroke Road..... | 1·14 | „ | Loch Quoich, Loan | 17·80 |
| „ | Ross, The Graig | 1·15 | „ | Drumnadrochit | 3·62 |
| „ | Shifnal, Hatton Grange..... | ·79 | „ | Skye, Dunvegan | 4·41 |
| „ | Droitwich | 1·05 | „ | N. Uist, Lochmaddy | 2·90 |
| „ | Blockley, Upton Wold..... | 1·01 | „ | Glencarron Lodge | 7·09 |
| VII. | Market Overton..... | ·91 | XIX. | Invershin | 2·40 |
| „ | Market Rasen..... | ·77 | „ | Melvich | 2·11 |
| „ | Bawtry, Hesley Hall | ·62 | „ | Loch Stack, Ardhullin | 4·49 |
| „ | Derby, Midland Railway..... | ·87 | XX. | Skibbereen Rectory | 3·24 |
| „ | Buxton | 2·12 | „ | Dunmanway, The Rectory ... | 4·90 |
| VIII. | Nantwich, Dorfold Hall | 1·25 | „ | Glanmire, Lota Lodge, No. 1 | 2·34 |
| „ | Chatburn, Middlewood | 1·83 | „ | Mitchelstown Castle..... | 2·10 |
| „ | Cartmel, Flookburgh | 2·48 | „ | Darrynane Abbey..... | 2·66 |
| IX. | Langsett Moor, Up. Midhope | 1·39 | „ | Clonmel, Bruce Villa | 1·87 |
| „ | Scarborough, Scalby | ·82 | „ | Newmarket-on-Fergus, Fenloe | 1·67 |
| „ | Ingleby Greenhow | 1·02 | XXI. | Laragh, Glendalough | 4·57 |
| „ | Mickleton | 2·46 | „ | Ballycumber, Moorock Lodge | 1·01 |
| X. | Bellingham, High Green Manor | 1·75 | „ | Ballbriggan, Ardgillan | ·70 |
| „ | Ilderton, Lilburn Cottage ... | ·94 | XXII. | Woodlawn | 2·21 |
| „ | Keswick, The Bank..... | 4·38 | „ | Westport, St. Helens ... | 3·88 |
| XI. | Llanfrehfa Grange | 2·61 | „ | Dugort, Slievemore Hotel ... | 4·54 |
| „ | Treherbert, Tyn-y-waun | 4·76 | „ | Mohill Rectory | 1·86 |
| „ | Carmarthen, The Friary | 2·79 | XXIII. | Enniskillen, Portora..... | 2·02 |
| „ | Castle Malgwyn [Llechryd]... | 2·49 | „ | Dartrey [Cootehill] | 1·58 |
| „ | Crickhowell, Tal-y-maes..... | 4·20 | „ | Warrenpoint, Manor House .. | 1·69 |
| „ | New Radnor, Ednol | 2·10 | „ | Banbridge, Milltown | ·85 |
| „ | Birmingham WW., Tyrmynydd | 3·09 | „ | Belfast, Cave Hill Road | 1·48 |
| „ | Lake Vyrnwy | 3·02 | „ | Glenarm Castle..... | 2·66 |
| „ | Llangyhanfal, Plâs Draw..... | 1·08 | „ | Londonderry, Creggan Res... | 2·34 |
| „ | Dolgelly, Bryntirion..... | 2·42 | „ | Dunfanaghy, Horn Head ... | 3·38 |
| „ | Bettws-y-Coed, Tyn-y-bryn... | 3·27 | „ | Killybegs | 3·24 |

METEOROLOGICAL NOTES ON FEBRUARY, 1913.

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.—The early part of the month was generally cloudy with occasional light R and high temp. Fogs were very prevalent from the 11th to the 15th and temp. was much lower. The latter part was fair or fine and dry, only .07 in. of R falling after the 15th. Mean temp. $41^{\circ}0$ or $1^{\circ}3$ above the average. Duration of sunshine $44^{\circ}4^*$ hours, & of R 28.0 hours. Evaporation .32 in. Shade max. $55^{\circ}1$ on 4th; min. $24^{\circ}1$ on 23rd. F 12, f 17.

TENTERDEN.—The first week was wet, but the rest was dry with fogs from 11th to 15th. The latter half was cold but sunny. Duration of sunshine 89.0† hours. Shade max. $54^{\circ}5$ on 11th; min. $27^{\circ}0$ on 19th. F 7, f 17.

TOTLAND BAY.—Duration of sunshine $84^{\circ}5^*$ hours. Shade max., $52^{\circ}6$ on 27th; min., $30^{\circ}1$ on 19th. F 7, f 12.

PITSFORD.—A fine dry month and good for farming operations. Shade max. $56^{\circ}4$ on 9th; min. $22^{\circ}6$ on 23rd. F 18.

IPSWICH, COPDOCK.—A fine dry month with plenty of sunshine after the middle, previous to which there were several days of mist and fog. Duration of sunshine $80^{\circ}7^{\dagger}$ hours. Mean temp. $40^{\circ}0$ or $1^{\circ}0$ above the average. Shade max. $53^{\circ}3$ on 11th; min. $28^{\circ}2$ on 22nd. F 10, f 23.

ROUSDON.—The first 10 days were rough and stormy. After the 10th the weather was fine and dry, but with cold E. winds.

NORTH CADBURY.—Warm, windy and cloudy from 2nd to 9th; dense fogs from 11th to 15th; bitter N.E. winds, dry and clear from 16th to 21st, and then S.E. winds with warmer weather. Shade max. $57^{\circ}2$ on 4th and 25th; min. $25^{\circ}5$ on 12th. F 11, f 20.

HODSOCK PRIORY.—A dry and mild month with no severe frost. The first week was very blustery, and the second week was foggy. Shade max. $55^{\circ}1$ on 9th; min. $25^{\circ}0$ on 23rd. F 15, f 23.

SOUTHPORT.—Duration of sunshine $54^{\circ}6^*$ hours, and of R 28.3 hours. Mean temp. $41^{\circ}2$ or $1^{\circ}9$ above the average. Evaporation .41 in. Shade max. $53^{\circ}0$ on 4 days; min. $28^{\circ}0$ on 19th. F 7, f 19.

HULL.—Duration of sunshine $27^{\circ}0^*$ hours. Shade max. $55^{\circ}0$ on 11th; min. $28^{\circ}0$ on 22nd. F 11, f 21.

HAVERFORDWEST.—Sunshine $77^{\circ}8^*$ hours. Shade max. $54^{\circ}0$ on 18th; min. $24^{\circ}2$ on 21st.

LLANDUDNO.—Shade max. $57^{\circ}0$ on 25th; min. $32^{\circ}0$ on 23rd.

CARGEN.—The first 10 days were wet and stormy with a severe S.W. gale in the night of 7th. Dry and calm from 11th to 28th. Owing to absence of sun and drying winds, ploughing was somewhat retarded on low lying fields. Shade max. $51^{\circ}5$ on 26th; min. $24^{\circ}0$ on 23rd. F 9.

EDINBURGH.—S.W. gales and generally unsettled until 10th. Calm later with high bar. and a deficiency of bright sunshine. Shade max. $52^{\circ}1$ on 11th; min. $30^{\circ}4$ on 23rd. F 3, f 11.

COUPAR ANGUS.—Temp. high; sunshine and frost deficient. An ideal month whereby the farmer has brought up arrears of work. Shade max. $51^{\circ}0$ on 4th; min. $26^{\circ}0$ on 19th.

LOCH STACK.—Duration of sunshine $37^{\circ}5^*$ hours.

WATERFORD.—Mean temp. $42^{\circ}5$; 13 days without R from 11th to 23rd. Shade max. $53^{\circ}0$ on 7th; min. $29^{\circ}0$ on 28th. F 7.

DUBLIN.—Although R fell daily on the first 9 days the month proved dry on the whole. No R fell from 10th to 23rd, but dense fogs on 11th and 3 following days yielded .01 in. This foggy period was followed by a spell of cold and dry E. winds. Shade max. $56^{\circ}1$ on 7th; min. $32^{\circ}3$ on 14th. F 1, f 4.

WARRENPOINT.—Excepting the first 10 days it was a fine month, 13 consecutive days being dry. The prevailing winds were from the E. and S.W. and at times reached gale force. Temp. was about normal.

* Campbell-Stokes.

† Jordan.

Climatological Table for the British Empire, September, 1912.

| STATIONS. (Those in italics are South of the Equator.) | Absolute. | | | | Average. | | | | Absolute. | | Total Rain | | Aver. Cloud. |
|--|-----------|--------|----------|--------|----------|------|---------------|-----------|-----------------|-------------------|------------|-------|-----------------|
| | Maximum. | | Minimum. | | Max. | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth. | Days. | |
| | Temp. | Date. | Temp. | Date. | | | | | | | | | |
| | | | | | | | | | | | | | |
| London, Camden Square | 69·4 | 4 | 35·7 | 27 | 62·4 | 46·6 | 47·7 | 81 | 117·6 | 31·8 | 2·14 | 6 | 6·0 |
| Malta | 79·7 | 12 | 62·1 | 7 | 75·3 | 67·7 | 64·7 | 81 | 146·0 | .. | 3·11 | 11 | 5·1 |
| Lagos | 86·0 | 27, 30 | 71·0 | 11, 12 | 83·4 | 73·9 | 71·4 | 76 | 158·0 | 69·0 | 2·12 | 17 | 7·1 |
| Cape Town | 78·3 | 13 | 40·6 | 10 | 63·6 | 49·2 | 49·9 | 77 | ... | ... | 4·21 | 14 | 6·3 |
| Johannesburg | 80·3 | 18 | 31·4 | 11 | 70·1 | 46·2 | 29·7 | 44 | 135·8 | 28·1 | ·32 | 2 | ... |
| Mauritius | 82·0 | 28 | 57·1 | 18 | 77·7 | 63·1 | 60·9 | 74 | 149·0 | 50·2 | 1·56 | 20 | 6·0 |
| Bloemfontein | 83·9 | 17 | 29·7 | 1 | 71·5 | 40·3 | 31·8 | 44 | ... | ... | ·02 | 1 | 2·5 |
| Calcutta... .. | 94·1 | 13 | 76·3 | 27 | 90·2 | 78·8 | 77·2 | 81 | ... | 72·5 | 5·11 | 10 | 6·9 |
| Bombay... .. | 90·2 | 24 | 74·6 | 7 | 86·7 | 77·3 | 75·1 | 81 | 128·7 | 70·6 | 3·09 | 17 | 5·0 |
| Madras | 98·2 | 13 | 71·1 | 17 | 94·5 | 78·4 | 75·6 | 77 | 149·2 | 72·7 | 1·36 | 5 | 4·7 |
| Kodaikanal | 70·6 | 11 | 50·0 | 3 | 66·2 | 52·2 | 51·9 | 81 | 150·9 | 37·6 | 7·04 | 13 | 6·8 |
| Colombo, Ceylon | 90·0 | 23 | 74·6 | 28 | 87·7 | 78·0 | 73·0 | 73 | 151·6 | 69·3 | 3·87 | 12 | 6·4 |
| Hongkong | 92·5 | 10 | 68·0 | 17 | 85·5 | 75·5 | 69·6 | 71 | 145·9 | ... | 3·88 | 11 | 5·3 |
| Sydney | 88·0 | 30 | 41·8 | 2 | 69·8 | 52·6 | 42·5 | 49 | 132·6 | 32·9 | ·40 | 12 | 3·5 |
| Melbourne | 81·2 | 29 | 36·0 | 1 | 62·9 | 45·8 | 42·5 | 61 | 134·9 | 29·4 | 2·35 | 20 | 6·1 |
| Adelaide | 81·2 | 28 | 39·3 | 19 | 65·6 | 49·0 | 47·4 | 67 | 140·7 | 32·3 | 2·64 | 17 | 4·8 |
| Coolgardie | 92·8 | 22 | 38·0 | 18 | 72·4 | 46·3 | 43·0 | 40 | 155·0 | 31·2 | ·33 | 4 | 2·7 |
| Hobart, Tasmania .. | 76·0 | 29 | 38·0 | 16, 17 | 58·3 | 43·6 | 39·7 | 63 | 127·8 | 29·6 | 3·82 | 20 | 6·9 |
| Wellington | 62·6 | 8 | 40·4 | 24 | 58·1 | 48·9 | 46·1 | 76 | 125·0 | 31·0 | 5·78 | 24 | 7·3 |
| Auckland | 64·5 | 17 | 45·0 | 29 | 60·5 | 49·6 | 49·3 | 81 | 127·0 | 40·0 | 5·53 | 26 | 6·9 |
| Jamaica, Kingston .. | 92·7 | 7 | 71·8 | 1 | 90·4 | 73·9 | 71·4 | 78 | ... | ... | 1·58 | 6 | 4·9 |
| Grenada | 90·0 | 24 | 72·0 | 15 | 86·5 | 75·4 | 76·4 | ... | 140·0 | ... | 6·35 | 22 | 3·0 |
| Toronto | 92·7 | 10 | 36·3 | 30 | 70·9 | 54·4 | ... | ... | 137·8 | 30·0 | 3·28 | 14 | 6·0 |
| Fredericton | 76·0 | 15 | 32·2 | 22 | 65·8 | 43·7 | ... | 79 | ... | ... | 4·05 | 9 | 6·6 |
| St. John, N.B. | 71·2 | 11 | 38·5 | 22 | 61·5 | 48·6 | ... | 77 | ... | ... | 3·45 | 11 | 5·7 |
| Edmonton, Alberta ... | 77·6 | 11 | 22·0 | 26 | 61·0 | 36·6 | ... | 76 | 125·4 | 15·2 | ·76 | 5 | 3·6 |
| Victoria, B.C. | 78·4 | 14 | 41·7 | 24 | 66·5 | 47·9 | ... | 77 | ... | ... | ·66 | 7 | 4·0 |

MALTA.—Mean temp. of air 71°·0. Average hours of daily sunshine 8·0.

Johannesburg.—Bright sunshine 312·9 hours.

Mauritius.—Mean temp. of air 0°·4 and R ·03 in. above averages. Mean hourly velocity of wind 11·1 miles or 0·5 miles above average.

Bloemfontein.—Drought bad, nothing for cattle to graze, thousands have died. Fountains dried up, and a scarcity of water nearly everywhere.

KODAIKANAL.—Bright sunshine 120 hours. TSS on 17 days.

COLOMBO.—Mean temp. of air 82°·9 or 2°·2 above, of dew point 0°·3 below, and R ·78 in. below, averages. Mean velocity of wind 7·4 miles per hour. TSS on 14th and 26th.

HONGKONG.—Mean temp. of air 79°·6. Mean hourly velocity of wind 10·9 miles. Bright sunshine 220·5 hours.

Sydney.—Mean temp. of air 2°·4 above, and R 2·45 in. below, averages.

Adelaide.—Mean temp. of air 0°·3 above, and R ·82 in. above, averages.

Hobart.—Mean temp. of air 0°·2 above, and R 1·71 in. above, averages.

Wellington.—Mean temp. of air 3°·5 above, and R 1·52 in. above, averages. Bright sunshine 137·2 hours.

Auckland.—A stormy and showery month. R more than two inches above average.

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VOL. XLVIII.

NORTH ATLANTIC ICE OBSERVATIONS.

As a result of the recommendations of the Commission of Enquiry into the loss of the *Titanic*, after collision with an iceberg in the North Atlantic in April, 1912, the British Government decided that investigations should be set on foot with a view to warning shipping of the movements of ice in the Atlantic north of the steamer tracks. While larger schemes requiring time for their elaboration and involving considerable expense in their execution are under consideration, a preliminary step has been taken by the Board of Trade, in conjunction with the principal shipowners, who divide the expense with the Government, in dispatching a vessel early last month.

The ship selected is the *Scotia*, an old Norwegian whaler, which was practically rebuilt by the famous yacht designer, G. L. Watson of Troon, in 1902, for the Scottish Antarctic expedition under Dr. W. S. Bruce. A photograph of the vessel appeared in this Magazine for December, 1902 (Vol. 37, p. 177). She has been fitted with a powerful wireless telegraphy installation to enable her to report at frequent intervals to the Marconi stations on the coast of Newfoundland and Labrador, the messages will be forwarded thence to the Meteorological Office, which has undertaken the collection of the data and their utilization on the weekly ice maps published on the Pilot Charts. We suppose that the *Scotia* will also communicate with liners at sea in case of need. The investigation ship is under the command of her old captain, Mr. Thomas Robertson, who has had unique experience of ice-navigation in both the Arctic and the Antarctic regions. He is one of the most experienced of the whalers still sailing from Dundee, and in the voyage of Dr. Bruce and on other occasions has had considerable practice in making oceanographical observations. The scientific staff on board is under the charge of Mr. D. J. Matthews, one of the most accomplished practical oceanographers in the country, whose work on the English Channel and its approaches carried out for the International Council for the Study of the Sea is well known. He has the assistance of two other scientific men. One of these is qualified for the study of

plankton—the minute organisms which are invaluable in the investigation of ocean currents, as their character often indicates the place of origin of the water. The other is a trained meteorologist, so that there is no doubt that valuable additions will be made not only to our knowledge of ice-movements, but to the physical conditions of sea and air on which these movements ultimately depend.

It is gratifying that this country should have taken the initiative in a work of such scientific and practical importance ; and we observe with no less pleasure that investigations of a somewhat similar character are being undertaken simultaneously by the Canadian Government.



ROYAL METEOROLOGICAL SOCIETY.

At the meeting of the Royal Meteorological Society, held on March 12th, at the Surveyors' Institution, Great George Street, Westminster, Mr. C. J. P. Cave, President, in the chair, Mr. R. G. K. Lempfert, Superintendent of the Forecast Branch of the Meteorological Office, delivered a lecture on "British Weather Forecasting, Past and Present."

The lecturer gave a very interesting account of the origin and evolution of weather forecasting in this country. He traced the development of the present system from the first attempts to construct synoptic weather maps, and recalled that the first weather reports were produced by Glaisher as early as 1849, and that stimulus was given to the matter by the great exhibition of 1851.

The utilization of telegraphy, for the rapid collection of meteorological data, was the first important step in development. This was discussed at the British Association Meeting, at Aberdeen, in 1859, and in the following summer Admiral Fitzroy commenced the systematic study of simultaneous meteorological observations for the Meteorological Department of the Board of Trade. Among the lantern slides exhibited was an early issue of Fitzroy's Weather Report, which, we were interested to observe, was in the familiar handwriting of Mr. G. J. Symons at a period which must have immediately preceded his resignation from the Meteorological Department in order to take up his life work in connection with the study of British Rainfall.

The first use to which the data thus brought together was put was not forecasting of weather so much as the issue of storm warnings to fishing vessels. The necessity of even this does not seem to have been realised until the nation was awakened by the great *Royal Charter* disaster, which stimulated the hitherto somewhat languid interest in the subject.

Fitzroy's first scheme, produced early in 1860, involved only *occasional* reports from stations in the extreme west, but on April 4th

of that year, before this scheme had come into operation, the French astronomer, Le Verrier, wrote asking for a *regular* exchange of daily observations. This led to the establishment of a regular service in September, 1860. From this time forward the collection of meteorological statistics, within a few hours of their having been observed, has been carried on without intermission; and Mr. Lempfert gave an extremely interesting account of the part played by various newspapers in helping forward this great national work. At the death of Admiral Fitzroy, in 1865, the work of the Meteorological Office was placed in charge of a committee of the Royal Society, and the forecasts which Fitzroy had commenced to make on a somewhat ambitious scale were for a time discontinued. Various experimental investigations were made during the following years, that of the phenomenon of weather travel, which was exploited by Gordon Bennett of the *New York Herald*, being among the number.

In 1879 forecasting was resumed as the result of numerous petitions, and it has from that time been continued without interruption. The newspaper press again played a large part in the encouragement of the work, and *The Times*, the *Standard*, and the *Daily News* for many years bore the entire charges of the evening services.

The lecturer gave a very detailed account of the various extensions which have been made in the observation area, and made it possible for the audience to realise the immense amount of organization and patient grappling with difficulties carried out by Dr. R. H. Scott, who succeeded in practically completing the network of land stations, and more recently by the exertions of Dr. W. N. Shaw, the present Director. The story of the international negotiations, which have led to the wide exchange of information, and the prompt manner in which advantage has been taken of any new means by which the area could be extended, such, for example, as the laying of a new cable, bear witness to the zeal and energy of the Meteorological Office; and the most recent triumph of the utilization of wireless telegraphy, so as to bring a portion of the hitherto unknown ocean area into the scheme, formed a fitting climax.

A description was given of the elaborate and careful methods by which the weather forecasts, and especially the storm-warnings which are issued, are subsequently checked, and the large proportion of successful forecasts is a sufficient guarantee that the labour is not ill-spent.

A very hearty vote of thanks were proposed by Mr. Mellish and seconded by Mr. Druce.

The following were elected Fellows of the Society:—Messrs. A. J. Ashdown, D. K. Syed Ebrahim, C. F. W. Halliley, Rabbi J. L. Levy, D.D., I. V. Margary, James Watt, F.R.S.E., W.S., H. L. Wilkinson; Mrs. Theodore Williams.

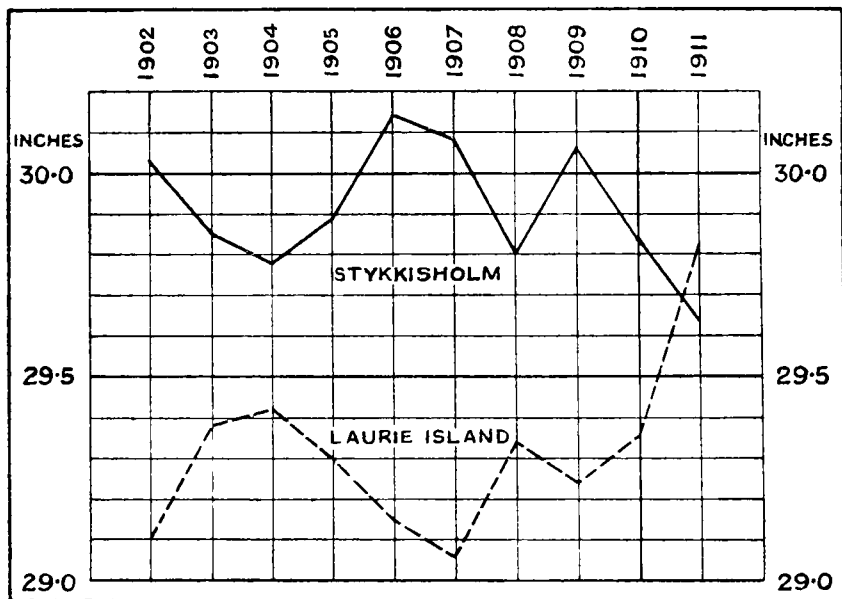
SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

By R. C. MOSSMAN, F.R.S.E.
(of the Argentine Meteorological Office).

(Second Article).

IN the month of May a most pronounced opposition is shown between the barometric pressure at Stykkisholm, Iceland, lat. 65° N., and Laurie Island, South Orkneys, lat. 61° S. Stykkisholm, it is almost superfluous to remark, is situated in the vicinity of the great North Atlantic "centre of action," while the South Orkneys are located a little to the N.W. of one of the most pronounced Antarctic

BAROMETRIC PRESSURE IN MAY AT STYKKISHOLM, ICELAND (LAT. 65° N.)
AND LAURIE ISLAND, SOUTH ORKNEYS (LAT. 61° S.)



"centres of action," viz., that in the Weddell Sea. The mean barometric pressure* at these two places for the month under review

* For Stykkisholm data I am indebted to Captain Ryder, Director of the Danish Meteorological Institute. The South Orkney data from 1904 to 1911 are taken, by kind permission of Mr. W. G. Davis, from Vol. 17 of the *Anales* (Part II.) now in course of publication by the Argentine Meteorological Office. The 1903 data are from the *Scotia Reports*, while the value for May, 1902, is from Tafel 3 of the *Meteorologischer Atlas, Deutsche Südpolar-Expedition, 1901-1903*, von Wilhelm Meinardus und Ludwig Mecking, Berlin, 1911. I am also indebted to Dr. W. N. Shaw for St. Helena data to end of 1911, in continuation of data given in publication M.O. 203.

is as follows, the values being given reduced to sea-level and gravity at lat. 45°.

| | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1910. | 1911. | Mean. |
|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | ins. | ins. | ins. | ins. | ins. | ins. | ins. | ins. | ins. | ins. | ins. |
| Stykkisholm (65° N. lat.) | 30·03 | 29·85 | 29·78 | 29·89 | 30·14 | 30·08 | 29·80 | 30·06 | 29·83 | 29·63 | 29·91 |
| Laurie Island .. (61° S. lat.) | 29·10 | 29·38 | 29·42 | 29·30 | 29·15 | 29·06 | 29·34 | 29·24 | 29·36 | 29·82 | 29·32 |

The above data are shown graphically in the foregoing curves. Expressed as departures from the normal the above values show the following deviations :—

| | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1910. | 1911. |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | in. | in. | in. | in. | in. | in. | in. | in. | in. | in. |
| Stykkisholm.. | +0·12 | —0·06 | —0·13 | —0·02 | +0·23 | +0·17 | —0·11 | +0·15 | —0·08 | —0·28 |
| S. Orkneys .. | —0·22 | +0·06 | +0·10 | —0·02 | —0·17 | —0·26 | +0·02 | —0·08 | +0·04 | +0·50 |

The correlation co-efficient deduced from these values is 0·90, and probable error = 0·12.

An examination of the barometric data for May at a number of stations on the South Atlantic littoral, shows that in South America, south of about latitude 47°, the pressure departures from the normal are in harmony with those observed at the South Orkneys and South Georgia. At Punta Arenas, situated in Magellan Strait, the correlation weakens, this station being located on the wind divide that separates Pacific from Atlantic influences. Even here, however, the May pressure departures differ from those at Stykkisholm in 75 per cent. of the 23 years during which a comparison could be made (1889–1911). The physical processes that in May month bring about a high pressure in the Icelandic region, are thus associated with a lowering of pressure over the south temperate and sub-antarctic Atlantic areas. Having examined barometric data from inter-tropical regions, including St. Helena, and also from the Azores, eastern Europe, and the United States of America with indefinite results, I have come to the conclusion that the dominating factor influencing these May pressure variations in the North and South Atlantic is to be found in the polar regions. Owing to lack of data it has not been possible to ascertain whether the thermal equator oscillated to any extent during the month of May in the period under consideration, so as to cause changes in the general circulation of the atmosphere. As to *why* the above striking differences should obtain only in the month of May no explanation can be offered. No break has yet shown itself in the sequence, as in May, 1912, an inspection of Icelandic and south Atlantic data (the latter represented by South Georgia and Punta Arenas) shows a rise of pressure over the former and a marked fall over the latter area, when compared with the very abnormal features of May, 1911.

In order to ascertain the effect on southern wind circulation (as represented by data from Punta Arenas and the adjacent station of Evangelists Island, at the Pacific entrance to the Straits of Magellan, for both of which places we have observations of wind direction from 1899 to 1909), the May records of the two three-year groups, 1900, 1904, and 1905, and of 1899, 1902, and 1907, have been taken. At Punta Arenas the Mays of the first group show a mean departure of pressure (normal 1889-1911) of +0.181 in., and of the second group —0.213 in. The corresponding departures from the normal at Stykkisholm were —0.069 in. and +0.125 in. respectively. Similarly, to see what difference existed in the North Atlantic circulation for these two series of years, May wind data were extracted from the summaries given in the Journals of the Scottish Meteorological Society. These comprise the frequency of the wind for the whole of that country based on all the returns, for two stations in Scotland North (Bressay Sound and North Unst), for four stations in Scotland West (Cape Wrath, Butt of Lewis, Barra Head and Skerryvore), for three stations in Scotland East (Kinnaird Head, Aberdeen and Bell Rock), and finally for all England.* The values, based on observations taken twice a day, have all been reduced to percentages, and in the following table (1) refers to the Mays of 1900, 1904 and 1905, with pressure high in the extreme South and low in the far North Atlantic, and (2) to the Mays of 1899, 1902 and 1907, when the reverse conditions of barometric pressure obtained in the regions under consideration :—

| | PUNTA ARENAS. | | EVANGELISTS ISLAND. | | SCOTLAND. | | | | | | | | ENGLAND. | |
|------|------------------|-----|------------------------|-----|-------------------|-----|--------|-----|-------|-----|-------|-----|----------|-----|
| | | | | | Whole Country. | | North. | | West. | | East. | | | |
| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| N. | 12 | 13 | 6 | 5 | 8 | 14 | 16 | 29 | 9 | 16 | 12 | 19 | 12 | 15 |
| N.E. | 11 | 12 | 5 | 3 | 12 | 14 | 17 | 21 | 13 | 16 | 16 | 19 | 15 | 13 |
| E. | 7 | 6 | 8 | 3 | 13 | 20 | 6 | 9 | 11 | 23 | 7 | 10 | 7 | 9 |
| S.E. | 4 | 0 | 18 | 6 | 8 | 8 | 13 | 9 | 10 | 10 | 8 | 10 | 6 | 7 |
| S. | 12 | 3 | 20 | 11 | 11 | 6 | 14 | 6 | 16 | 9 | 21 | 10 | 10 | 8 |
| S.W. | 27 | 11 | 14 | 15 | 15 | 10 | 12 | 7 | 16 | 10 | 14 | 10 | 17 | 12 |
| W. | 20 | 35 | 9 | 33 | 17 | 13 | 11 | 12 | 14 | 10 | 9 | 11 | 14 | 14 |
| N.W. | 7 | 20 | 14 | 24 | 11 | 10 | 10 | 6 | 10 | 6 | 12 | 10 | 12 | 12 |
| Calm | 0 | 0 | 6 | 0 | 5 | 5 | 1 | 1 | 1 | 0 | 1 | 1 | 7 | 10 |

It will be seen that in Mays with high pressure at Punta Arenas, the winds there show a marked excess (as compared with Mays in which pressure is low) from the S.W. and S., while those from W. and N.W. are in defect. At Evangelists Island where the winds are free from the effect of land disturbance, marked differences are also apparent between the two three-year groups. Here in Mays with high pressure the prevailing direction is from the south (S.E., S. and S.W.), while in Mays with low pressure the predominant winds are

* See Marriott, Variations in the English Climate during the Thirty Years 1881-1910. *Quar. Jour. Roy. Met. Soc.*, Vol. 37, July, 1911. Table I.

westerly (S.W., W. and N.W.). Without entering into details, it may be stated that in the Mays of 1900, 1904 and 1905 the barometric gradient on the S. Atlantic and Pacific coasts between the latitudes of 40° and $52\frac{1}{2}^{\circ}$ S. latitude was only one-quarter of that observed in the Mays of 1899, 1902 and 1907, which clearly points during the first three Mays to a northward extension of the anticyclone which normally covers the south of Grahams Land south of the Antarctic circle. In the second group, embracing the Mays of 1899, 1902 and 1907, the region south of Cape Horn was the theatre of cyclonic activity, with a very steep gradient south of the 40th parallel.

In the northern Atlantic area represented by the groupings for Scotland and England, there are also pronounced variations in the wind circulation during the two groups of years. The Mays of 1900, 1904 and 1905 with pressure at Iceland below the normal, show an excess of south and south-west, and a defect of north and east winds, compared with the Mays of 1899, 1902 and 1907, when pressure at Stykkisholm was in excess of the normal, thus intensifying the easterly current. The differences between the two groups are smaller in England than in Scotland, and the contrast is most pronounced in Scotland W. or the region nearest to the North Atlantic low pressure area. It is of interest to note that the mean temperature of the Mays of 1900, 1904 and 1905 with pressure below normal in Iceland were warmer in Britain than those of 1899, 1902 and 1907 (Iceland pressure above normal) to the extent of $1^{\circ}4$ in England, $1^{\circ}6$ in Scotland, $1^{\circ}8$ in Scotland W., $1^{\circ}5$ in Scotland E., and $0^{\circ}9$ in Scotland N.

THE WEATHER OF MARCH.

OVER the whole of the British Isles the conditions were of a changeable type with frequent precipitation, which, in the northern part of the kingdom, was often in the form of sleet or snow.

At the beginning of the month a large anticyclone with pressure above 30.3 inches covered the east and south of England and extended over France and Germany. This occasioned southerly winds over the British Isles which blew freshly on the northern and north-western coasts. As this system moved away to the east an Atlantic depression approached, causing heavy rain in Ireland and lesser falls over the United Kingdom generally. Temperature rose to above 50° over the greater part of the kingdom. On the 4th the centre of a very deep depression, with minimum readings below 27.9 inches, moved north-eastward across Iceland, and south-westerly gales were experienced over the British Isles. The passage of several Atlantic depressions over these Islands during the days following resulted in a succession of southerly or westerly gales over a wide area. Temperature remained high, 55° , or above, being recorded on several days in different parts of the kingdom. Many stations experienced the highest temperature of the month between

the 4th and 6th, maximum readings of 57° being registered in many places, 58° in the west of Ireland and 59° in the London area. On the 7th and 8th the maxima were generally below 50° and were only a little higher on the 9th and 10th. On the 11th 55° was recorded in many districts during the day, but frosts occurred in the midland and south-eastern counties at night. A "V-shaped" depression that appeared over the western and northern parts of the Kingdom travelled quickly eastward, and rain, sleet or snow fell generally in the west and north. During the 13th a large and deep depression advanced over Iceland, and southerly gales occurred on the north-western coasts of the British Isles. On the 14th a decided fall in temperature occurred, and rain, sleet or snow fell generally on that and the following day. On the night of the 16th a small depression passed over the south and east of England, and the weather continued very unsettled. Frequent gales, with rain or snow, occurred, generally with temperature below the average except in the east and south-east of the country. On the 18th the temperature failed to reach 45° in many parts, and on the following day it reached 50° in the south-west and south, but in the north of Scotland only touched 40° . This was the coldest day of the month in most localities, and frosts occurred over practically the whole kingdom. The minima at Crieff, Marchmont and Fulbeck, were 20° , and at West Linton, 16° . A small depression developed off the south-west of England on the 22nd and travelled across the country during the night, causing severe southerly and south-westerly gales in the Channel and in the south of England. Rain fell generally, and thunderstorms occurred in many places. Fresh winds or gales blew during the week following, with unsettled weather generally. As a rule the western parts of the kingdom enjoyed fairer conditions than the eastern. Temperature fluctuated frequently, but on the whole did not differ greatly from the average. A reading of 58° occurred on the 29th at Killarney, and 55° or above was recorded in many districts.

The rainfall of the month was in excess of the average over practically the whole kingdom. Rather less than 2 inches fell over the extreme eastern counties, and practically the whole of the Thames Valley had less than 4 inches. Nearly 9 inches fell over an area on Dartmoor, many stations in Brecon had over 10 inches, and an area in the Lake District had over 15 inches. In Scotland less than 3 inches fell on the low land of Aberdeenshire, but at Loan, in Inverness, the fall exceeded 18 inches. The rainfall in Ireland varied from about 2 inches in Dublin to 6 or 7 inches in the western counties, and over 10 inches in County Kerry. The general rainfall over the great divisions of the kingdom, expressed as a percentage of the average, was as follows:—England and Wales, 169; Scotland, 159; Ireland, 145; British Isles, 159.

The duration of bright sunshine differed but slightly from the average generally.

THAMES VALLEY RAINFALL — MARCH, 1913.



ALTITUDE
SCALE

| | | | |
|----------------|-----------------|------------------|-----------------|
| Below 250 feet | 250 to 500 feet | 500 to 1000 feet | Above 1000 feet |
|----------------|-----------------|------------------|-----------------|

SCALE OF MILES
0 5 10 15 20

INTERNATIONAL BALLOON ASCENTS.

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

August 11th, 1910.

| Starting Point | Country. | A miles. | B ° F. | C miles | D ° F. | E miles | F |
|-------------------|--------------|-------------|-----------|------------|-----------|------------|------------|
| Manchester | England ... | 7.5 | —74 | 11.9 | —65 | 116 | S.E. by E. |
| Pyrton Hill | " ... | 7.8 | —87 | 9.2 | —71 | 70 | S.E. by E. |
| Oughterard | Ireland | 7.6 | —71 | 9.4 | —56 | 52 | E. by N. |
| Brussels | Belgium .. | 6.8 | —72 | 10.3 | —58 | 61 | S. |
| Hamburg | Germany .. | 6.9 | —71 | 9.6 | —56 | 25 | S.S.W. |
| Lindenberg | " .. | 6.8 | —60 | 9.6 | —54 | 65 | S.S.E. |
| Paris | France | 6.5 | —56 | 9.2 | —56 | 12 | S. |
| Strassburg | Germany .. | 6.3 | —58 | 11.3 | —56 | 26 | S.E. by S. |
| " | " .. | 6.3 | —60 | 8.3 | —60 | 47 | S. by W. |
| Vienna | Austria | 6.8 | —71 | 13.1 | ? | 12 | E. by S. |
| Pavia | Italy | 6.9 | —78 | 8.9 | —60 | 55 | W.S.W. |
| Nizhni Olchedaëff | Russia | 6.2 | —58 | 9.8 | —53 | 57 | E. by N. |
| Ekaterinberg ... | " | 6.5 | —58 | 10.6 | —53 | 77 | N.E. |

August 12th, 1910.

| | | | | | | | |
|-------------------|--------------|-----|-----|------|-----|-----|------------|
| Petersfield | England ... | 7.6 | —71 | 8.8 | —72 | 200 | E. by S. |
| Brussels | Belgium ... | 7.7 | —85 | 10.4 | —65 | 60 | S.E. |
| Hamburg | Germany .. | 6.8 | —71 | 7.8 | —62 | 35 | E.S.E. |
| Lindenberg | " .. | 7.3 | —87 | 14.0 | —56 | 21 | S.E. |
| Paris | France | 7.9 | —74 | 9.7 | —64 | 103 | E.S.E. |
| Strassburg | Germany .. | 7.3 | —69 | 8.3 | —64 | 51 | S. |
| Vienna | Austria | 6.6 | —65 | 13.8 | —45 | 17 | S.E. by S. |
| Pavlovsk | Russia | 5.8 | —63 | 10.8 | —49 | 46 | E. |
| Nizhni Olchedaëff | " | 6.1 | —56 | 8.8 | —53 | 33 | N.E. by E. |

August 13th, 1910.

| | | | | | | | |
|-------------------|-------------|-----|-----|------|-------|-----|------------|
| Brussels | Belgium ... | 7.9 | —71 | 8.6 | —69 | 119 | S.S.E. |
| Lindenberg | Germany ... | 6.5 | —45 | 11.3 | ? | 63 | S.S.E. |
| Paris | France | 8.0 | —72 | 10.4 | —67 | 95 | S.E. by S. |
| Strassburg | Germany .. | 7.7 | —72 | 10.3 | —71 | 72 | S.E. by S. |
| Munich | " .. | 8.6 | —69 | 9.7 | —60 | 66 | S.E. by S. |
| Vienna | Austria ... | 7.7 | —72 | 12.1 | —50 ? | 42 | S.E. |
| Pavia | Italy | 7.9 | —74 | 9.7 | —78 | 39 | S.E. by S. |
| Pavlovsk | Russia | 5.4 | —51 | 10.7 | —45 | 19 | S. |
| Nizhni Olchedaëff | " | 7.2 | —65 | 7.8 | —53 | 31 | S. by E. |

A Height in miles of commencement of isothermal column.

B Temperature, F°, at bottom of column.

C Greatest height of reliable record in miles.

D Temperature, F°, at greatest height.

E Distance in miles of point where balloon fell.

F Bearing of falling point from starting point.

During the three days shown above, and, in fact, during the whole week, very uniform barometric conditions prevailed; but, on the whole, the barometer was lower to the eastward. The figures present no unusual features, except one or two high temperatures at the top, which may, perhaps, be due to solar radiation.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE LOWEST BAROMETER ON RECORD IN NEW YORK.

ON January 3rd, 1913, this city was visited by a phenomenal storm. At 9 a.m. the barometer stood as low as 29.15 in., and was falling rapidly, the wind was light, with a dense fog on the river. About 2 p.m. pressure had fallen to 28.61 in., which is the lowest reading ever known in this city; the wind then rose rapidly, and soon attained a velocity of 87 miles an hour. The maximum temperature was 56°, and by 8 p.m. it had fallen to 30°, and it was snowing.

The barometer recovered from this decline abnormally slowly, and the following morning the wind was blowing at the rate of 60 miles an hour. The precipitation that attended this storm was less than .50 in.

C. DECKER.

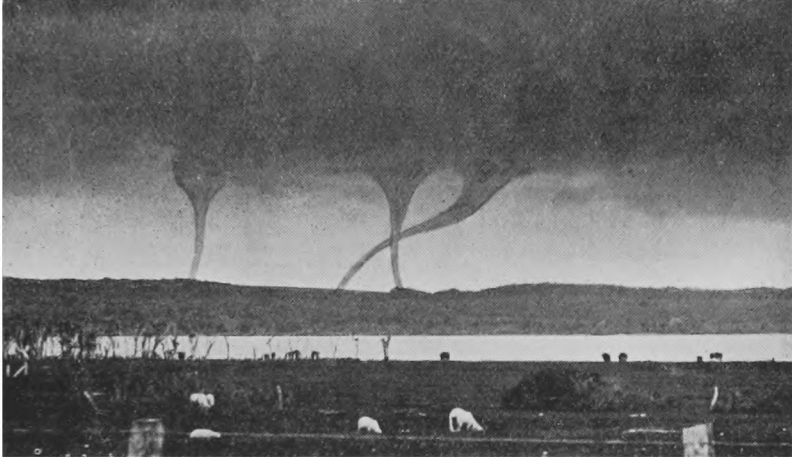
65, West 50th Street, New York, January 9th, 1913.

WATERSPOUTS AT THE CHATHAM ISLANDS.

WATERSPOUTS were observed here on November 10th, 1912, and the following notes, if not of scientific value, may be of interest.

The weather for some days previous had been unsettled, and on the 9th there was thunder and lightning, with showers. The sky cleared after nightfall, and the night of the 9th was clear and starlight, the wind being S.E. On the morning of the 10th the weather was clear, but it began to cloud over at about 10 a.m., when we again had thunder and lightning. On the morning of the 10th I was sitting in the porch facing north-north-east at about 10 a.m., enjoying the bright sunshine. Gradually the sky became overcast, and there was a dense rain-cloud above, as shown in the photograph. Below the bank of clouds to sea level it was quite clear and bright, and towards the eastward heavy rain was evidently falling. From the porch, where I and my daughter were sitting, we had a very good view of the sea. A little after 11 a.m. my daughter drew my attention to a peculiar funnel-shaped form which was beginning to appear on the lower edge of the cloud bank. I saw at once that something very out of the common was beginning, and said "Well, I have never seen a waterspout, but it looks to me as if this was one forming." We then carefully watched, and it was soon plainly evident that a waterspout was taking place. We marked how the funnel-shaped excrescence from the cloud bank gradually extended downwards to the sea, and from below we could observe another funnel rising which soon joined the one above; the whole appearance had that of a spiral tube evidently formed by a rotary

motion ; the water on the sea end of the spout was in a perfect foam. The spout first formed was to the right hand on the eastward side next to where the heavy rain was evidently falling. Almost immediately after the formation of the first spout another began to make its appearance. It was much thicker than the first, and, as in that case, the sea below the cloud was violently agitated, and even from where we stood, which must have been quite seven or eight miles



distant, the form like columns was plainly seen. This was by far the largest of the spouts, and continued for nearly half an hour. Towards the end, before the spout began to subside, the sea had almost the appearance of a geyser, so violently was it agitated. I think the large one must have been nearer to us than the first, for as the first began to dissolve it gradually drifted towards the big one, and soon the remains appeared as a sort of appendix hanging from the cloud above. The spouts disappeared slowly, and the whole phenomenon occupied about three-quarters of an hour.

Chatham Islands.

F. A. D. COX, LIEUT., R.N.

CURIOUS PHENOMENON.

At 11 p.m., on Monday, 17th March, the air was calm after a squally day, and the stars were visible through a damp haze, temperature being just above 32° F., I heard sounds like a shower of small pebbles on the roofs of neighbouring houses, evidently due to the slates crackling. I have noticed this phenomenon on one previous occasion under precisely similar conditions of weather, but have never seen mention of it anywhere. Perhaps some of your readers have had a similar experience.

A. S. MARTIN-SMITH.

Cedar Villa, Wood Street, Barnet, 2nd April, 1913.

ORIGIN OF THE SNOWDON GAUGE.

It may interest some of your readers to know the origin of the so-called Snowdon Gauge. When my old friend Mr. Symons came down to my house at Calne to see my rain gauges, 9 of the elevation series and 14 of the magnitude series, on July 15th, 1863, he was much struck by an 8-inch gauge (an ordinary white metal one invented by Mr. Rowden, a chemist in Calne, where the gauge was made) with a rim of the same height as that of the Snowdon Gauge. Mr. Rowden was a very keen observer of rainfall, and he told me that he had for some time noticed that, in our stormy weather on the Wiltshire Downs, the wind blew out both rain and snow in the low-rimmed gauge—and he lent me his new one to try it with my 8-inch gauge, with the result that it invariably collected more than the low-rimmed one. Mr. Symons was so much interested that he forthwith started the Snowdon. I think it should have been called the “Rowden.” He was with me four days, and had a good opportunity of testing the two, the weather being stormy.

MICHAEL FOSTER WARD.

Upton Park, Slough, 19th February, 1913.

THE RAINFALL OF THE WINTER SIX MONTHS, 1912-1913.

As was the case in the six months, October, 1911, to March, 1912, the rainfall of the winter six months ending March, 1913, was decidedly in excess of the average amount. The period was, however, not so notable in this respect as on that occasion; and in fact the months of October and November were almost exactly normal in point of view of total general rainfall, whilst February was in all parts of the kingdom a distinctly dry month. December was wet in all parts; and January, though dry in England, was much less so in

Rainfall, October, 1912- -March, 1913, when the Average is taken as 100.

| | ENGLAND & WALES. | SCOTLAND. | IRELAND. | BRITISH ISLES. |
|------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 1912-1913. | As per cent. of Average. | As per cent. of Average. | As per cent. of Average. | As per cent. of Average. |
| October | 99 | 106 | 88 | 98 |
| November ... | 92 | 113 | 86 | 97 |
| December ... | 131 | 159 | 143 | 143 |
| January | 66 | 95 | 174 | 147 |
| February ... | 60 | 80 | 71 | 69 |
| March | 169 | 159 | 145 | 160 |
| October to March | <u>118</u> | <u>119</u> | <u>118</u> | <u>119</u> |

Scotland, and was very wet in Ireland. March was relatively the wettest month of the season, though the actual amount of rain measured was larger both in December and January. An interesting feature is the unusual uniformity of the rainfall in relation to the average, which is noticeable in every month except January. This is even more striking when the period is considered as a whole, the excess of 19 per cent. being substantially identical in all the great divisions of the British Isles.

REVIEWS.

Weather Science. By R. G. K. LEMPFERT, M.A., Superintendent of the Forecast Division of the Meteorological Office. London, T. C. & E. C. Jack. Not dated. Size $6\frac{1}{2} \times 4$. Pp. 94.

THIS is the latest of the important group of small books on meteorology by responsible authors, which has been brought into existence by the competition of rival series of popular scientific booklets. Mr. Lempfert's work is welcome in a special degree as a simple and authoritative introduction to the study of the weather charts and forecasts of the Meteorological Office, which are the most widely disseminated, generally read and, we fear, least understood by the people, of all the products of Government endowment of science. It would be possible to criticise any treatment of any branch of science contained in less than 100 pages by just complaints of what has been left out, for it is obvious that completeness of presentation within such limits is impossible, but this really matters little for the aspects ignored by the writer in one series are usually those which are most fully dealt with by the writers in other series, and taking together all the popular books on meteorology reviewed in these pages during the last year the public of to-day can obtain at a moderate price a far better outline of meteorology than was ever available before.

We cannot resist calling attention to the slip on p. 12, "The normal height of the barometer is 760 centimetres or 29.92 inches." This, of course is the veriest inadvertence, but the fact that it was not noticed by the proof readers shows that the metric system is still very far from being familiar to the British mind. We venture to think that if the slip had been feet for inches, instead of centimetres for millimetres, the printer's reader would have queried the statement.

On p. 23 the average rainfall of the British Islands is given as 25 inches per annum. This is an error which a printer could hardly detect, but it is obviously a slip for 35 inches, and even so, we are inclined to think that 40 inches would be nearer the truth. As a historical point we may observe that the word "recent" on p. 69 might well have been omitted from the statement that "In the southern hemisphere recent Antarctic expeditions have also met with easterly wind after the west wind belt of the 'roaring forties' had been left behind." Such winds were reported by the earliest Antarctic explorers. The best chapter is in our opinion the last, which treats of the Upper Air, and we rejoice to see that Mr. Lempfert adopts the term stratosphere in place of the ambiguous or even misleading phrase isothermal column.

Der tägliche Gang der Lufttemperatur in Deutschland, von [The daily march of Air Temperature in Germany, by] DR. H. HENZE. (*Veröffentlichungen des Königlich Preussischen Meteorologischen Instituts*, Nr. 254.) Berlin, 1912. Size 13 × 10, pp. 47, 1 plate. Price 4 marks.

THE phenomenon of the diurnal variation of temperature in Germany is somewhat fully discussed in this publication, together with the different combinations of hours that have been adopted for deducing the true daily mean. The periodic daily amplitude of temperature or difference between the mean of the warmest and coldest hour—a quantity naturally somewhat smaller than the aperiodic amplitude or difference between the mean daily extremes—is greater, as we should expect, in the inland regions than near the coast, and in summer than in winter. It ranges on the average of the year among the places given from 7.1°C (12.7°F) at Eberswald to 1.36°C (2.4°F) at the high-level station of Schneekoppe. At Potsdam the amplitude minimum of 2.08°C (3.7°F) for sixteen years' observations taken in an open field occurs in December, and the maximum of 8.94°C (16.0°F) in June. The minimum temperature on the average of the various German places occurs some two hours before sunrise in the winter months, less than an hour before at midsummer, and slightly after sunrise in part of the spring and autumn. We know, of course, from observations in England that the minimum temperature is more liable to occur at any time during the long winter nights than during the shorter nights at other seasons, when loss of heat by radiation goes on more definitely till sunrise.

The times of occurrence of the daily maximum temperature agree at the several stations better than is the case with the minimum. At stations where the thermometers are placed on a tower the maximum occurs later than at those where the observations are made near the ground. The average interval between the times of maximum and minimum is six hours in winter and eleven in summer.

L.C.W.B.

The Liability to Drought in India as compared with that in other Countries. By GILBERT T. WALKER, C.S.I., M.A., Sc.D., F.R.S. (Memoirs of the Indian Meteorological Department.) Simla, 1912. Size 12 × 9, pp. 9. Price 8 annas.

THIS is only a preliminary investigation, prompted by the occurrence of severe famines from time to time in India, which naturally suggest the question whether the rainfall of India is more variable than that of other parts of the world. Famine may, of course, result from excessive rain at wrong seasons, as well as from the dearth of it at the right time, and Dr. Walker points out that an adequate treatment of the subject must needs be based upon a knowledge of the agricultural conditions of different countries. Droughts in

countries like India or Australia, with a burning sun and hot dry winds, are shown to be much more harmful than, for instance, those in a temperate region like North America or Europe. It is concluded from a statement of figures showing percentage deficiencies of annual rainfall, that of those countries which are dependent on agriculture and are not liable to famine, there is none which has such a precarious rainfall as India.

L.C.W.B.

Data of Heavy Rainfall over Short Periods in India. By GILBERT T. WALKER, C.S.I., M.A., Sc.D., F.R.S. (Memoirs of the Indian Meteorological Department). Calcutta, 1912. Size $12\frac{1}{2} \times 10$, pp. 110. Price 1 rupee.

PART I. of this publication consists of a series of Tables, arranged in chronological order, showing the data of all daily falls of rain exceeding ten inches between 1891 and 1911 in each of the chief political divisions into which India is divided, and also such fragmentary records as are available previous to 1891, while Part II. shows the short bursts of heavy rain—3 inches or more in 3 hours—at various places during a longer or shorter period of years. According to a supplementary statement extracted from Mr. Blanford's "Climates and Weather of India," 12 inches fell in three hours at Calcutta on May 11th, 1835, whilst 17 inches in 12 hours fell at Madras on October 21st, 1846. Cases of falls at rates of between 2 and 3 inches an hour are, as one might expect in a hot monsoon country, quite common. Dr. Walker points out that reliable information regarding the maximum amount of rain to be expected within short periods, over various districts of India, is in considerable demand now owing to the extension of irrigational and commercial works dependent upon rainfall, and that the data are published in a concise form to meet this want. It is proposed to afford better equipment in the matter of self-recording rain gauges at the various Indian observatories, so that the hourly rainfall may be more closely studied.

L.C.W.B.

METEOROLOGICAL NEWS AND NOTES.

THE HIGH-LEVEL OBSERVATORY IN TENERIFFE, which was established by Professor Hergesell on the Cañadas (the crater-floor from which the famous Peak rises), has now been taken over by the Spanish Government, and placed under the charge of Señor Juan García de Lomas Lobaton. We understand that the meteorology of Teneriffe is to be investigated by the establishment of several new observing stations at various levels.

RAINFALL TABLE FOR MARCH, 1913.

| STATION. | COUNTY. | Lat. N. | Long. W. [°E.] | Height above Sea. ft. | RAINFALL OF MONTH. | |
|--------------------------------------|----------------------|------------|----------------------|--------------------------------|--------------------------------|--------------|
| | | | | | Aver. 1875— 1909. in. | 1913. in. |
| Camden Square..... | London..... | 51 32 | 0 8 | 111 | 1·70 | 2·29 |
| Tenterden..... | Kent..... | 51 4 | *0 41 | 190 | 1·95 | 2·66 |
| Arundel (Patching)..... | Sussex..... | 50 51 | 0 27 | 130 | 1·95 | 3·19 |
| Fawley (Cadland)..... | Hampshire..... | 50 50 | 1 22 | 52 | 2·17 | ... |
| Oxford (Magdalen College)..... | Oxfordshire..... | 51 45 | 1 15 | 186 | 1·45 | 2·25 |
| Wellingborough (Croyland Abbey)..... | Northampton..... | 52 18 | 0 41 | 174 | 1·69 | 3·08 |
| Shoeburyness..... | Essex..... | 51 31 | *0 48 | 13 | 1·19 | 1·65 |
| Bury St. Edmunds (Westley)..... | Suffolk..... | 52 15 | *0 40 | 226 | 1·71 | 1·91 |
| Geldeston [Beccles]..... | Suffolk..... | 52 27 | *1 31 | 38 | 1·57 | 1·84 |
| Polapit Tamar [Launceston]..... | Devon..... | 50 40 | 4 22 | 315 | 2·74 | 5·24 |
| Rousdon [Lyme Regis]..... | "..... | 50 41 | 3 0 | 516 | 2·30 | 2·88 |
| Stroud (Upfield)..... | Gloucestershire..... | 51 44 | 2 13 | 226 | 2·01 | 3·75 |
| Church Stretton (Wolstaston)..... | Shropshire..... | 52 35 | 2 48 | 800 | 2·19 | 5·84 |
| Coventry (Kingswood)..... | Warwickshire..... | 52 24 | 1 30 | 340 | 1·89 | 3·82 |
| Boston..... | Lincolnshire..... | 52 58 | 0 1 | 11 | 1·47 | 2·35 |
| Worksop (Hodsock Priory)..... | Nottinghamshire..... | 53 22 | 1 5 | 56 | 1·70 | 2·74 |
| Macclesfield..... | Cheshire..... | 53 15 | 2 7 | 501 | 2·50 | 4·41 |
| Southport (Hesketh Park)..... | Lancashire..... | 53 38 | 2 59 | 38 | 2·11 | 3·42 |
| Arncliffe Vicarage..... | Yorkshire, W.R..... | 54 8 | 2 6 | 732 | 5·17 | 10·43 |
| Wetherby (Ribston Hall)..... | "..... | 53 59 | 1 24 | 130 | 1·92 | 2·98 |
| Hull (Pearson Park)..... | "..... E.R..... | 53 45 | 0 20 | 6 | 1·84 | 2·41 |
| Newcastle (Town Moor)..... | Northumberland..... | 54 59 | 1 38 | 201 | 2·10 | 2·55 |
| Borrowdale (Seathwaite)..... | Cumberland..... | 54 30 | 3 10 | 423 | 10·63 | 16·22 |
| Cardiff (Ely)..... | Glamorgan..... | 51 29 | 3 13 | 53 | 2·89 | 5·89 |
| Haverfordwest..... | Pembroke..... | 51 48 | 4 58 | 90 | 3·16 | 6·18 |
| Aberystwyth (Gogerddan)..... | Cardigan..... | 52 26 | 4 1 | 83 | 3·04 | 6·27 |
| Llandudno..... | Carnarvon..... | 53 20 | 3 50 | 72 | 2·13 | 3·81 |
| Cargen [Dunfries]..... | Kirkcudbright..... | 55 2 | 3 37 | 80 | 3·33 | 5·77 |
| Marchmont House..... | Berwick..... | 55 44 | 2 24 | 498 | 2·64 | 3·34 |
| Girvan (Pinnore)..... | Ayr..... | 55 10 | 4 49 | 207 | 3·62 | 4·77 |
| Glasgow (Queen's Park)..... | Renfrew..... | 55 53 | 4 18 | 144 | 2·61 | 4·52 |
| Inveraray (Newtown)..... | Argyll..... | 56 14 | 5 4 | 17 | 5·41 | 9·85 |
| Mull (Quinish)..... | "..... | 56 34 | 6 13 | 35 | 4·28 | 7·80 |
| Dundee (Eastern Necropolis)..... | Forfar..... | 56 28 | 2 57 | 199 | 2·06 | 3·58 |
| Braemar..... | Aberdeen..... | 57 0 | 3 24 | 1114 | 2·87 | 5·26 |
| Aberdeen (Cranford)..... | "..... | 57 8 | 2 7 | 120 | 2·65 | 3·74 |
| Cawdor..... | Nairn..... | 57 31 | 3 57 | 250 | 2·35 | 2·68 |
| Fort Augustus (S. Benedict's)..... | E. Inverness..... | 57 9 | 4 41 | 68 | 3·79 | 6·77 |
| Loch Torridon (Bendamph)..... | W. Ross..... | 57 32 | 5 32 | 20 | 7·29 | 12·19 |
| Dunrobin Castle..... | Sutherland..... | 57 59 | 3 56 | 14 | 2·64 | 2·35 |
| Wick..... | Caithness..... | 58 26 | 3 6 | 77 | 2·24 | 3·16 |
| Killarney (District Asylum)..... | Kerry..... | 52 4 | 9 31 | 178 | 4·51 | 6·39 |
| Waterford (Brook Lodge)..... | Waterford..... | 52 15 | 7 7 | 104 | 2·64 | 3·51 |
| Nenagh (Castle Lough)..... | Tipperary..... | 52 54 | 8 24 | 120 | 2·99 | 5·62 |
| Ennistymon House..... | Clare..... | 52 57 | 9 18 | 37 | 3·24 | 5·96 |
| Gorey (Courtown House)..... | Wexford..... | 52 40 | 6 13 | 80 | 2·28 | 2·32 |
| Abbey Leix (Blandsfort)..... | Queen's County..... | 52 56 | 7 17 | 532 | 2·59 | 3·28 |
| Dublin (Fitz William Square)..... | Dublin..... | 53 21 | 6 14 | 54 | 1·98 | 2·16 |
| Mullingar (Belvedere)..... | Westmeath..... | 53 29 | 7 22 | 367 | 2·64 | 4·05 |
| Crossmolina (Enniscoe)..... | Mayo..... | 54 4 | 9 16 | 74 | 4·36 | 7·37 |
| Cong (The Glebe)..... | "..... | 53 33 | 9 16 | 112 | 3·80 | 6·59 |
| Collooney (Markree Obsy.)..... | Sligo..... | 54 11 | 8 27 | 127 | 3·33 | 5·05 |
| Seaforde..... | Down..... | 54 19 | 5 50 | 180 | 2·84 | 3·09 |
| Bushmills (Dundarave)..... | Antrim..... | 55 12 | 6 30 | 162 | 2·73 | 3·09 |
| Omagh (Edenfel)..... | Tyrene..... | 54 36 | 7 18 | 280 | 2·98 | 3·77 |

RAINFALL TABLE FOR MARCH, 1913—*continued.*

| RAINFALL OF MONTH (<i>con.</i>) | | | | | 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. in. | 1913. in. | Diff. from Aver. in. | % of Av. | | |
| | | in. | Date. | | | | | | in. | |
| + .59 | 135 | .32 | 16 | 21 | 5.19 | 5.65 | + .46 | 109 | 25.11 | Camden Square |
| + .71 | 136 | .53 | 16 | 24 | 5.99 | 8.18 | +2.19 | 137 | 27.64 | Tenterden |
| +1.24 | 164 | .52 | 16 | 23 | 6.71 | 9.98 | +3.27 | 149 | 30.48 | Patching |
| ... | ... | ... | ... | ... | 7.20 | ... | ... | ... | 31.87 | Cadland |
| + .80 | 155 | .35 | 16 | 20 | 4.85 | 5.66 | + .81 | 117 | 24.58 | Oxford |
| +1.39 | 182 | .73 | 16 | 20 | 5.27 | 6.94 | +1.67 | 132 | 25.17 | Croyland Abbey |
| + .46 | 139 | .25 | 21 | 22 | 3.71 | 4.30 | + .59 | 116 | 19.28 | Shoeburyness |
| + .20 | 112 | .31 | 16 | 19 | 5.00 | 5.24 | + .24 | 105 | 25.40 | Westley |
| + .27 | 117 | .31 | 31 | 18 | 4.51 | 5.15 | + .64 | 114 | 23.73 | Geldeston |
| +2.50 | 191 | .83 | 22 | 24 | 9.28 | 14.16 | +4.88 | 153 | 38.27 | Polapit Tamar |
| + .58 | 125 | .48 | 29 | 20 | 7.74 | 10.68 | +2.94 | 138 | 33.54 | Rousdon |
| +1.74 | 187 | .57 | 16 | 23 | 6.46 | 9.88 | +3.42 | 153 | 29.81 | Stroud |
| +3.65 | 267 | .83 | 22 | 25 | 6.87 | 10.95 | +4.08 | 159 | 32.41 | Wolstaston |
| +1.93 | 202 | .81 | 16 | 14 | 6.12 | 9.52 | +3.40 | 156 | 28.98 | Coventry |
| + .88 | 160 | .52 | 14 | 19 | 4.54 | 5.74 | +1.20 | 126 | 23.35 | Boston |
| +1.04 | 161 | .46 | 14 | 19 | 5.04 | 6.46 | +1.42 | 128 | 24.46 | Hodsock Priory |
| +1.91 | 176 | .88 | 22 | 23 | 7.46 | 9.07 | +1.61 | 122 | 34.73 | Macclesfield |
| +1.31 | 162 | .61 | 22 | 24 | 6.73 | 8.37 | +1.64 | 124 | 32.70 | Southport |
| +5.26 | 202 | 1.69 | 2 | 27 | 16.31 | 23.04 | +6.73 | 141 | 61.49 | Arneliffe |
| +1.06 | 155 | .45 | 19 | 25 | 5.52 | 6.25 | + .73 | 113 | 26.87 | Ribston Hall |
| + .57 | 131 | .38 | 16 | 20 | 5.32 | 6.86 | +1.54 | 129 | 26.42 | Hull |
| + .45 | 121 | .63 | 22 | 19 | 5.63 | 8.39 | +2.76 | 149 | 27.94 | Newcastle |
| +5.59 | 153 | 2.20 | 3 | 25 | 35.03 | 42.43 | +7.40 | 121 | 129.48 | Seathwaite |
| +3.00 | 204 | .98 | 22 | 26 | 9.61 | 15.10 | +5.49 | 157 | 42.28 | Cardiff |
| +3.02 | 195 | .94 | 23 | 26 | 11.27 | 16.55 | +5.28 | 147 | 46.81 | Haverfordwest |
| +3.23 | 206 | 1.00 | 22 | 27 | 10.04 | 14.47 | +4.43 | 144 | 45.46 | Gogerddan |
| +1.68 | 179 | .74 | 22 | 25 | 6.75 | 8.19 | +1.44 | 121 | 30.36 | Llandudno |
| +2.44 | 173 | 1.00 | 22 | 24 | 10.85 | 14.98 | +4.13 | 138 | 43.47 | Cargen |
| + .70 | 127 | .81 | 22 | 24 | 7.19 | 7.58 | + .39 | 105 | 33.76 | Marchmont |
| +1.15 | 132 | 1.02 | 18 | 24 | 12.27 | 13.10 | + .83 | 107 | 49.77 | Girvan |
| +1.91 | 173 | .47 | 4 | 23 | 8.84 | 10.87 | +2.03 | 123 | 35.97 | Glasgow |
| +4.44 | 182 | 1.04 | 9 | 25 | 18.46 | 21.10 | +2.64 | 114 | 68.67 | Inveraray |
| +3.52 | 182 | 1.01 | 1 | 25 | 14.28 | 17.29 | +3.01 | 121 | 56.57 | Quinish |
| +1.52 | 174 | .73 | 22 | 20 | 5.98 | 7.67 | +1.69 | 128 | 28.64 | Dundee |
| +2.39 | 183 | 1.11 | 6 | 19 | 8.34 | 11.48 | +3.14 | 138 | 34.93 | Braemar |
| +1.09 | 141 | 1.40 | 22 | 20 | 7.37 | 7.70 | + .33 | 104 | 32.73 | Aberdeen |
| + .33 | 114 | .47 | 22 | 14 | 6.69 | 6.06 | — .63 | 91 | 29.33 | Cawdor |
| +2.98 | 179 | .75 | 9 | 25 | 13.57 | 15.43 | +1.86 | 114 | 44.53 | Fort Augustus |
| +4.90 | 167 | 1.38 | 9 | 25 | 24.24 | 25.38 | +1.14 | 105 | 83.93 | Bendamp |
| — .29 | 89 | .48 | 19 | 18 | 7.97 | 4.35 | —3.62 | 55 | 31.90 | Dunrobin Castle |
| + .92 | 141 | .51 | 19 | 23 | 6.95 | 5.64 | —1.31 | 81 | 29.88 | Wick |
| +1.88 | 142 | .90 | 2 | 28 | 15.44 | 19.52 | +4.08 | 126 | 54.81 | Killarney |
| + .87 | 133 | .68 | 1 | 25 | 9.60 | 13.11 | +3.51 | 136 | 39.57 | Waterford |
| +2.63 | 188 | .81 | 2 | 25 | 9.76 | 13.59 | +3.83 | 139 | 39.43 | Castle Lough |
| +2.72 | 184 | .94 | 6 | 25 | 10.98 | 14.97 | +3.99 | 136 | 46.52 | Ennistymon |
| + .04 | 102 | .33 | 1 | 20 | 8.22 | 11.87 | +3.65 | 144 | 34.99 | Courtown Ho. |
| + .69 | 127 | .45 | 2 | 26 | 8.29 | 11.95 | +3.66 | 144 | 35.92 | Abbey Leix |
| + .18 | 109 | .27 | 2 | 22 | 6.05 | 8.34 | +2.29 | 138 | 27.68 | Dublin |
| +1.41 | 153 | .79 | 2 | 24 | 8.41 | 11.72 | +3.31 | 139 | 36.15 | Mullingar |
| +3.01 | 169 | .66 | 2 | 29 | 13.91 | 19.41 | +5.50 | 139 | 52.87 | Enniscoo |
| +2.79 | 173 | .78 | 2 | 26 | 12.31 | 18.46 | +6.15 | 150 | 48.90 | Cong |
| +1.72 | 152 | .40 | 15 | 24 | 10.40 | 14.16 | +3.76 | 136 | 42.71 | Markree |
| + .25 | 109 | .54 | 18 | 22 | 9.06 | 11.24 | +2.18 | 124 | 38.91 | Seaforde |
| + .36 | 113 | .36 | 7 | 20 | 8.48 | 6.86 | —1.62 | 81 | 37.56 | Dundarave |
| + .79 | 126 | .42 | 18 | 23 | 9.12 | 11.21 | +2.09 | 123 | 39.38 | Omagh |

SUPPLEMENTARY RAINFALL, MARCH, 1913.

| Div. | STATION. | Rain inches | Div. | STATION. | Rain inches. |
|-------|-------------------------------|----------------|--------|-------------------------------|-----------------|
| II. | Warlingham, Redvers Road.. | 3·75 | XI. | Lligwy | 3·44 |
| „ | Ramsgate | 1·93 | „ | Douglas | 4·12 |
| „ | Hailsham | 3·26 | XII. | Stoneykirk, Ardwell House... | 3·37 |
| „ | Totland Bay, Aston House... | 2·91 | „ | Dalry, The Old Garroch..... | 6·77 |
| „ | Stockbridge, Ashley | 3·32 | „ | Beattock, Kinnelhead | 8·81 |
| „ | Grayshott | 3·96 | „ | Langholm, Drove Road | 6·23 |
| „ | Caversham, Rectory Road ... | 2·11 | XIII. | Meggat Water, Cramilt Lodge | 6·46 |
| III. | Harrow Weald, Hill House... | 1·99 | „ | North Berwick Reservoir..... | 2·36 |
| „ | Pitsford, Sedgebrook..... | 2·93 | „ | Edinburgh, Royal Observatry. | 3·21 |
| „ | Woburn, Milton Bryant..... | 2·39 | XIV. | Maybole, Knockdon Farm ... | 3·40 |
| „ | Chatteris, The Priory..... | 2·39 | XV. | Ballachulish House | 14·16 |
| IV. | Colchester, Hill Ho., Lexden | 1·45 | „ | Campbeltown, Witchburn .. | 4·38 |
| „ | Newport, Belmont House | 1·82 | „ | Holy Loch, Ardnadam..... | 11·24 |
| „ | Ipswich, Rookwood, Copdock | 1·50 | „ | Islay, Eallabus | 5·76 |
| „ | Blakeney | 2·26 | „ | Tiree, Cornaigmore | 5·72 |
| „ | Swaffham | 2·04 | XVI. | Dollar Academy | 5·33 |
| V. | Bishops Cannings | 2·76 | „ | Balquhider, Stronvar..... | 10·86 |
| „ | Winterbourne Steepleton..... | ... | „ | Glenllyn, Meggernie Castle.. | 9·70 |
| „ | Ashburton, Druid House..... | 7·23 | „ | Blair Atholl | 5·37 |
| „ | Cullompton | 4·16 | „ | Coupar Angus | 5·26 |
| „ | Lynmouth, Rock House | 7·07 | „ | Montrose, Sunnyside Asylum. | 3·31 |
| „ | Okehampton, Oaklands..... | 6·77 | XVII. | Alford, Lynturk Manse | 3·75 |
| „ | Hartland Abbey..... | 5·02 | „ | Fyvie Castle | 2·88 |
| „ | Probus, Lamellyn..... | 3·77 | „ | Keith Station .. | 2·70 |
| „ | North Cadbury Rectory..... | 2·66 | XVIII. | Alvey Manse..... | 4·00 |
| VI. | Clifton, Pembroke Road.... | 4·33 | „ | Loch Quoich, Loan | 18·10 |
| „ | Ross, The Graig | 5·38 | „ | Drumadrochit | 5·46 |
| „ | Shifnal, Hatton Grange..... | 4·91 | „ | Skye, Dunvegan | 10·87 |
| „ | Droitwich | 4·28 | „ | N. Uist, Lochmaddy | 4·48 |
| „ | Blockley, Upton Wold..... | 4·24 | „ | Glencarron Lodge | 6·58 |
| VII. | Market Overton..... | 3·85 | XIX. | Invershin | 3·57 |
| „ | Market Rasen..... | 2·70 | „ | Melvich | 3·65 |
| „ | Bawtry, Hesley Hall | 2·30 | „ | Loch Stack, Ardochullin | 6·80 |
| „ | Derby, Midland Railway..... | 3·78 | XX. | Skibbereen Rectory | 4·67 |
| „ | Buxton | 6·38 | „ | Dunmanway, The Rectory .. | 7·22 |
| VIII. | Nantwich, Dorfold Hall | 4·14 | „ | Glanmire, Lota Lodge, No. 1 | 4·14 |
| „ | Chatburn, Middlewood | 5·80 | „ | Mitchelstown Castle..... | 4·03 |
| „ | Carmel, Flookburgh | 4·54 | „ | Darrynane Abbey..... | 6·32 |
| IX. | Langsett Moor, Up. Midhope | 5·52 | „ | Clonmel, Bruce Villa | 3·79 |
| „ | Scarborough, Scalby | 2·15 | „ | Newmarket-on-Fergus, Fenloe | 4·42 |
| „ | Ingleby Greenhow | 3·33 | XXI. | Laragh, Glendalough | 5·74 |
| „ | Mickleton | 6·70 | „ | Ballycumber, Moorock Lodge | 3·00 |
| X. | Bellingham, High Green Manor | 4·39 | „ | Balbriggan, Ardgillan | 1·98 |
| „ | Ilderton, Lilburn Cottage ... | 3·86 | XXII. | Woodlawn | 5·11 |
| „ | Keswick, The Bank..... | 6·91 | „ | Westport, St. Helens ... | 5·93 |
| XI. | Llanfrehfa Grange | 7·17 | „ | Dugort, Slievemore Hotel ... | 7·40 |
| „ | Treherbert, Tyn-y-waun | 15·00 | „ | Mohill Rectory | 4·28 |
| „ | Carmarthen, The Friary | 6·60 | XXIII. | Enniskillen, Portora..... | 3·73 |
| „ | Castle Malgwyn [Llechryd]... | 5·75 | „ | Dartrey [Cootehill] | 3·97 |
| „ | Crickhowell, Tal-y-maes | 9·50 | „ | Warrenpoint, Manor House .. | 4·31 |
| „ | New Radnor, Ednol | 5·05 | „ | Banbridge, Milltown | 2·44 |
| „ | Birmingham WW., Tyrmynydd | 9·59 | „ | Belfast, Cave Hill Road | 3·26 |
| „ | Lake Vyrnwy | 6·46 | „ | Glenarm Castle..... | 3·91 |
| „ | Llangyhanfal, Plás Draw..... | 4·63 | „ | Londonderry, Creggan Res... | 3·71 |
| „ | Dolgelly, Bryntirion..... | 6·69 | „ | Dunfanaghy, Horn Head ... | 4·41 |
| „ | Bettws-y-Coed, Tyn-y-bryn... | 7·67 | „ | Killybegs | 6·14 |

METEOROLOGICAL NOTES ON MARCH, 1913.

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.—A dull, showery and mild month, with a few bright springlike days. Fresh or squally winds, generally from between S. and W., were frequent, and TSS occurred on 17th, 20th and 22nd. Mean temp. $45^{\circ}0$ or $2^{\circ}9$ above the average. Duration of sunshine 78.1^* hours, and of R 47.2 hours. Evaporation $.77$ in. Shade max. $59^{\circ}3$ on 6th; min. $26^{\circ}0$ on 18th. F 3, f 11.

TENTERDEN.—Showery the first week, then a few dry days. Mostly wet after 13th and a good deal of wind, especially on 17th, 19th and 22nd. Duration of sunshine 113.0^{\dagger} hours. Mean temp. $44^{\circ}9$. Shade max. $58^{\circ}0$ on 29th; min. $28^{\circ}5$ on 18th. F 1, f 12.

TOTLAND BAY.—Very windy month. Duration of sunshine 121.5^* hours. Shade max., $53^{\circ}1$ on 30th; min., $29^{\circ}9$ on 18th. F 1, f 6.

PITSFORD.—Mean temp. $44^{\circ}8$. R 1.23 in. above the average. Shade max. $57^{\circ}1$ on 23rd; min. $24^{\circ}5$ on 12th. F 4.

IPSWICH, COPDOCK.—Duration of sunshine 103.6^{\dagger} hours. Mean temp. $43^{\circ}7$. Shade max. $57^{\circ}5$ on 6th; min. $28^{\circ}0$ on 17th. F 6, f 17.

POLAPIT TAMAR.—Wet and stormy with cold winds. Warmer towards the end. Shade max. $54^{\circ}0$ on 30th; min. $24^{\circ}1$ on 12th. F 4, f 13.

NORTH CADBURY.—A windy March with temp. decidedly above normal. Remarkable bar. fluctuations and great range of pressure. Shade max. $61^{\circ}0$ on 31st; min. $27^{\circ}5$ on 18th. F 5, f 18.

ROSS.—The wettest March for 94 years. Shade max. $57^{\circ}5$ on 31st; min. $26^{\circ}7$ on 18th. F 5, f 12.

HODSOCK PRIORY.—A mild month with frequent R and high winds. Shade max. $57^{\circ}1$ on 4th; min. $24^{\circ}0$ on 18th. F 6, f 20.

SOUTHPORT.—Duration of sunshine 116.9^* hours, and of R 70.8 hours. Mean temp. $43^{\circ}1$ or $1^{\circ}8$ above the average. Evaporation 1.31 in. Shade max. $56^{\circ}0$ on 31st; min. $27^{\circ}0$ on 18th. F 2, f 14.

HULL.—Generally mild, cloudy days with colder nights. S on 17th and 18th and sharp TS on night of 22nd. Duration of sunshine 75.5^* hours. Shade max. $57^{\circ}0$ on 4th; min. $28^{\circ}0$ on 18th. F 3, f 20.

GOSGERDAN.—Greater part of month stormy and cold. Very changeable from 14th to 18th. S, E, T, L, strong winds and spells of fine weather followed in quick succession. Great gale and heavy T at about midnight on 15th. Month closed much finer with wind in S.E.

LLANDUDNO.—Shade max. $55^{\circ}0$ on 31st; min. $29^{\circ}0$ on 18th.

MARCHMONT.—Duration of sunshine 119.9 hours on 25 days.

EDINBURGH.—Shade max. $53^{\circ}2$ on 31st; min. $24^{\circ}8$ on 18th. F 7, f 14.

ARDNADAM.—The first three weeks were cold, wet and stormy, but the last 10 days were dry and generally bright with keen winds. Shade max. $57^{\circ}5$ on 30th; min. $21^{\circ}9$ on 18th. F 7, f 19.

LYNTURK.—Rough and windy. Frequent S though to no great depth.

LOCH STACK.—Duration of sunshine 86.0^* hours.

DUNMANWAY.—The wettest March since 1905. Several fine and warm days, especially St. Patrick's Day and Easter Monday and Tuesday. S on night of 16th and frequent H showers during the month.

DUBLIN.—An unsettled windy month with moderate temp. and frequent though not heavy R. Showers of H, sleet or S on several days, and W. or S.W. winds. Mean temp. $43^{\circ}8$. Shade max. $57^{\circ}1$ on 4th; min. $28^{\circ}1$ on 18th. F 2, f 10.

BELFAST.—Until the 21st the weather was very severe and wintry, but afterwards it was ideal for the seed time.

KILLYBEGS.—A cold wet month with much E. wind.

* Campbell-Stokes.

† Jordan.

Climatological Table for the British Empire, October, 1912.

| STATIONS. (Those in italics are South of the Equator.) | Absolute. | | | | Average. | | | | Absolute. | | Total Rain | | Aver. Cloud. |
|--|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|-------------|-------|-----------------|
| | Maximum. | | Minimum. | | Max. | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth. | Days. | |
| | Temp. | Date. | Temp. | Date. | | | | | | | | | |
| London, Camden Square | 64°8 | 1 | 30°8 | 5 | 55°9 | 39°8 | 43°8 | 91 | 106°0 | 28°1 | inches 2·03 | 15 | 4·7 |
| Malta | 78·3 | 4 | 60·0 | 30 | 72·6 | 64·9 | ... | ... | 144·1 | ... | 1·17 | 8 | 4·5 |
| Lagos | 88·0 | Sev. | 71·0 | 13 | 86·6 | 74·6 | 73·3 | 75 | 168·0 | 68·0 | 3·96 | 14 | 6·7 |
| Cape Town | 91·8 | 29 | 43·5 | 22 | 71·7 | 54·0 | 52·1 | 68 | ... | ... | ·93 | 6 | 4·2 |
| Johannesburg | 87·0 | 14 | 35·7 | 6 | 76·5 | 51·0 | 40·7 | 50 | 149·2 | 37·0 | ·73 | 7 | 2·2 |
| Mauritius | 82·1 | 1 | 60·4 | 22 | 79·2 | 65·5 | 63·5 | 76 | 152·0 | 54·3 | 6·82 | 23 | 7·2 |
| Bloemfontein | 93·0 | 31 | 35·3 | 1 | 82·0 | 50·5 | 38·0 | 38 | ... | ... | 1·02 | 4 | 1·4 |
| Calcutta... .. | 91·9 | 13 | 67·3 | 31 | 87·5 | 74·0 | 73·2 | 79 | ... | 61·4 | 4·28 | 8 | 4·4 |
| Bombay | 92·4 | 19 | 73·1 | 29 | 88·9 | 77·5 | 74·0 | 76 | 136·0 | 62·6 | ·65 | 4 | 4·1 |
| Madras | 98·3 | 7 | 68·6 | 31 | 90·2 | 75·8 | 74·4 | 81 | 147·4 | 65·4 | 11·00 | 12 | 5·3 |
| Kodaikanal | 66·2 | 17 | 46·4 | 31 | 62·0 | 51·6 | 52·6 | 89 | 143·2 | 38·6 | 10·73 | 25 | 8·6 |
| Colombo, Ceylon | 88·2 | 26 | 72·6 | 25 | 85·4 | 75·7 | 73·8 | 80 | 151·5 | 65·9 | 14·21 | 25 | 7·6 |
| Hongkong | 90·2 | 28 | 69·5 | 17 | 81·5 | 72·1 | 64·6 | 68 | 136·4 | ... | ·02 | 1 | 4·0 |
| Sydney | 90·4 | 31 | 46·9 | 15 | 73·5 | 56·6 | 48·8 | 55 | 144·5 | 36·1 | 1·14 | 21 | 3·9 |
| Melbourne | 90·4 | 30 | 36·5 | 16 | 67·9 | 47·3 | 45·0 | 60 | 146·2 | 31·6 | 1·32 | 8 | 5·3 |
| Adelaide | 95·8 | 30 | 41·8 | 5, 14 | 72·2 | 50·9 | 47·0 | 55 | 149·9 | 33·7 | ·96 | 8 | 4·4 |
| Perth | 81·6 | 22 | 47·0 | 4 | 69·1 | 52·5 | 51·2 | 68 | 146·8 | 35·5 | 2·33 | 10 | 4·7 |
| Coolgardie | 97·4 | 15 | 40·0 | 21 | 78·9 | 50·9 | 43·6 | 41 | 162·0 | 37·0 | ·58 | 4 | 2·8 |
| Hobart, Tasmania | 77·6 | 7 | 37·2 | 14 | 60·8 | 46·0 | 42·2 | 63 | 144·0 | 30·0 | 3·31 | 17 | 6·6 |
| Wellington | 66·8 | 12 | 39·6 | 2 | 59·7 | 49·1 | 46·9 | 76 | 137·8 | 29·0 | 3·49 | 20 | 6·3 |
| Auckland | 68·0 | 6 | 43·0 | 26 | 61·9 | 50·2 | 49·9 | 79 | 138·0 | 47·6 | 2·09 | 17 | 6·3 |
| Jamaica, Kingston | 92·1 | 6 | 70·8 | 18 | 88·5 | 73·6 | 72·1 | 78 | ... | ... | 1·87 | 15 | ... |
| Grenada | 88·0 | Sev. | 73·0 | Sev. | 85·3 | 75·4 | ... | 78 | 139·0 | ... | 4·72 | 17 | 3·5 |
| Toronto | 73·8 | 6 | 30·1 | 16 | 59·6 | 41·7 | ... | 81 | 126·6 | 25·1 | 2·27 | 9 | ... |
| Fredericton | 77·8 | 6 | 25·0 | 21* | 55·3 | 34·7 | ... | 78 | ... | ... | 7·07 | 13 | 5·0 |
| St. John, N.B. | 68·0 | 5 | 32·0 | 16 | 53·5 | 42·6 | 42·0 | 76 | ... | ... | 3·23 | 15 | 4·9 |
| Edmonton, Alberta | 72·1 | 14 | 16·8 | 31 | 50·3 | 30·7 | ... | 71 | 118·2 | 6·0 | ·70 | 9 | 5·1 |
| Victoria, B.C. | 63·2 | 2 | 33·0 | 20 | 55·2 | 41·9 | 44·0 | 82 | ... | ... | 2·33 | 14 | 5·5 |

* and 30th.

MALTA.—Mean temp. of air 68°·1. Average daily sunshine 6·9 hours.

Johannesburg.—Bright sunshine 309·9 hours.

Mauritius.—Mean temp. of air 0°·3 below and R 5·54 in. above averages. Mean hourly velocity of wind 10·1 miles or 0·1 miles below average.

KODAIKANAL.—Bright sunshine 86 hours. TSS on 21 days.

COLOMBO.—Mean temp. of air 80°·6 or 0°·6 above, and R ·26 in. below, averages. Mean velocity of wind 5·2 miles per hour. TSS on 13 days.

HONGKONG.—Mean temp. of air 76°·1. Mean hourly velocity of wind 12·3 miles. Bright sunshine 241·6 hours.

Sydney.—Mean temp. of air 1°·6 above, and R 1·65 in. below, averages.

Melbourne.—Mean temp. of air 0°·1 above, and R 1·35 in. below, averages.

Adelaide.—Mean temp. of air 0°·3 below, and R ·82 in. below, averages.

Coolgardie.—Mean temp. of air 1°·4 above, and R slightly below, averages.

Hobart.—Mean temp. of air 0°·8 below, and R 50 per cent. above, averages.

Wellington.—Mean temp. of air 0°·5 below, and R ·77 in. below, averages. Bright sunshine 180·3 hours. H on 26th.

Auckland.—Cool, dry and windy. R considerably under average of 44 years.

Symons's Meteorological Magazine.

No. 568.

MAY, 1913.

VOL. XLVIII.

ABNORMAL RAINFALL IN CEYLON.

IN this Magazine for March last we inserted a note on the heavy rainfall of January, 1913, in Ceylon. The information reached us through a correspondent who had it we understand from a private source; and we are glad now to be able to supplement it by some fuller details from official records, for which we are indebted to the courtesy of Mr. A. J. Bamford, Acting Superintendent of the Colombo Observatory.

The heavy rainfall appears not to have been confined to the central parts of the island, since, although the actual maximum occurred near Kandy, a larger area was affected on the east coast.

The Supplement to the Government Gazette, from which the following statistics were drawn, contains the records of the total amount of rainfall, the number of days on which rain fell, and the day of maximum precipitation in twenty-four hours, during January, at 234 stations. It is, of course, impossible in our limited space to print more than a small selection of this large mass of data, but the map which Mr. Bamford has constructed, and which we reproduce in a generalized form on a small scale, represents the distribution of total rainfall for the month in a much more concise manner. The table which we print contains the names of stations, and the total rainfall in cases where the amount reached 50 inches. The positions of the stations may be ascertained by means of the reference numbers which have been placed upon the map. The whole of these stations lie in the district between Kandy and the east coast. At the two wettest stations, the enormous amount of over 100 inches of rain was recorded during the month. These were the Ledgerwatta Estate, 4 miles north of Badulla, at an altitude of 4,000 ft., with 108·01 in., and St. Martin's Estate, Rangalla, 15 miles E.N.E. of Kandy, at 3,600 ft., with 109·55 in. of rain. The rainfall, as will be seen by the map, fell off uniformly towards the west coast, on the whole length of which less than 10 inches fell. The northern extremity of Ceylon had less than 5 inches during the month.

TABLE I.—*Rainfall, January, 1913.*

| No. on Map. | STATION. | Altitude, feet. | Rainfall, in. |
|-------------|-------------------------------|-----------------|---------------|
| 1 ... | St. Martin's, Rangalla | 3600 | 109·55 |
| 2 ... | Ledgerwatta, Badulla | 4000 | 108·01 |
| 3 ... | Kobonella, Rangalla | 3300 | 81·85 |
| 4 ... | Kurundu-oya, Maturata | 5150 | 78·36 |
| 5 ... | Dooromadella, Gammaduwa..... | 2880 | 69·82 |
| 6 ... | Gammaduwa, Rattota | 2400 | 69·23 |
| 7 ... | Taldena | 1100 | 65·12 |
| 8 ... | Rugam | 77 | 63·40 |
| 9 ... | Maturata | 3226 | 60·18 |
| 10 ... | Unichchai..... | 120 | 60·13 |
| 11 ... | Pullukannawa..... | — | 58·65 |
| 12 ... | Rotawewa | 30 | 58·55 |
| 13 ... | Veeragoda | 99 | 58·24 |
| 14 ... | Devilana | 136 | 57·33 |
| 15 ... | Kahmunai | 12 | 57·25 |
| 16 ... | Kadukkamunai | — | 56·60 |
| 17 ... | Thumpenkeni | — | 56·49 |
| 18 .. | Manalpittyar Anicut | 21 | 55·90 |
| 19 ... | Kudawewa | 250 | 54·63 |
| 20 ... | Batticaloa | 26 | 53·77 |
| 21 ... | Pottuvil | 10 | 53·73 |
| 22 ... | Maragalla, Monaragala | 2200 .. | 53·26 |
| 23 ... | Madulsima | 4500 | 52·32 |
| 24 ... | Kabaragalla, Maturata | 4300 | 51·56 |
| 25 ... | Lahugalla..... | — | 51·45 |
| 26 .. | Chadiyantawala..... | 63 | 51·44 |
| 27 ... | Minneriya..... | 309 | 51·06 |
| 28 ... | Ampare..... | 125 | 50·06 |

The Island of Ceylon is, from its situation in the Indian Ocean, peculiarly liable to rainfalls of tropical intensity, and the relative importance of January, 1913, in its meteorological history may be

TABLE II.—*Highest Monthly Rainfall Recorded at First Class Stations in Ceylon.*

| STATIONS. | Highest in any month. | | Highest in any January. | | Total for Jan., 1913. |
|--------------------|-----------------------|--------------------------|-------------------------|------------|-----------------------|
| | in. | Date. | in. | Year. | in. |
| Colombo | 36·2 | Oct., 1870 | 12·6 | 1878 | 8·34 |
| Ratnapura | 43·4 | Sept., 1872 | 12·5 | 1870 | 15·64 |
| Puttalam | 29·0 | Oct., 1891 | 10·4 | 1899 | 8·56 |
| Anuradhapura..... | 26·5 | Dec., 1887 | 11·3 | 1871 | 12·68 |
| Manbar | 25·3 | Oct., 1891 | 8·9 | 1871 | 8·58 |
| Jaffna | 38·1 | Nov., 1906 | 9·0 | 1881 | 4·07 |
| Trincomalee..... | 35·2 | Nov., 1893 | 23·9 | 1878 | 29·12 |
| Batticaloa..... | 51·7 | Dec., 1898 | 26·9 | 1878 | 53·77 |
| Hambantota..... | 22·2 | Oct., 1877 | 10·9 | 1899 | 10·70 |
| Galle | 32·5 | Sept., 1877 | 12·8 | 1878 | 8·09 |
| Kandy | 25·3 | June, 1889 | 16·7 | 1871 | 22·58 |
| Nowara Eliya | 35·0 | Sep., 1872, Jul., 1882.. | 18·0 | 1892 | 24·75 |
| Badulla | 47·0 | Jan., 1892 | 47·0 | 1892 | 40·43 |
| Diyatalawa | 21·5 | Oct., 1902 | 11·4 | 1904 | 23·72 |
| Kurunegala | 33·4 | Oct., 1891 | 9·5 | 1892 | 17·79 |
| Kalutara..... | 32·6 | Sept., 1877 | 19·6 | 1878 | 8·96 |

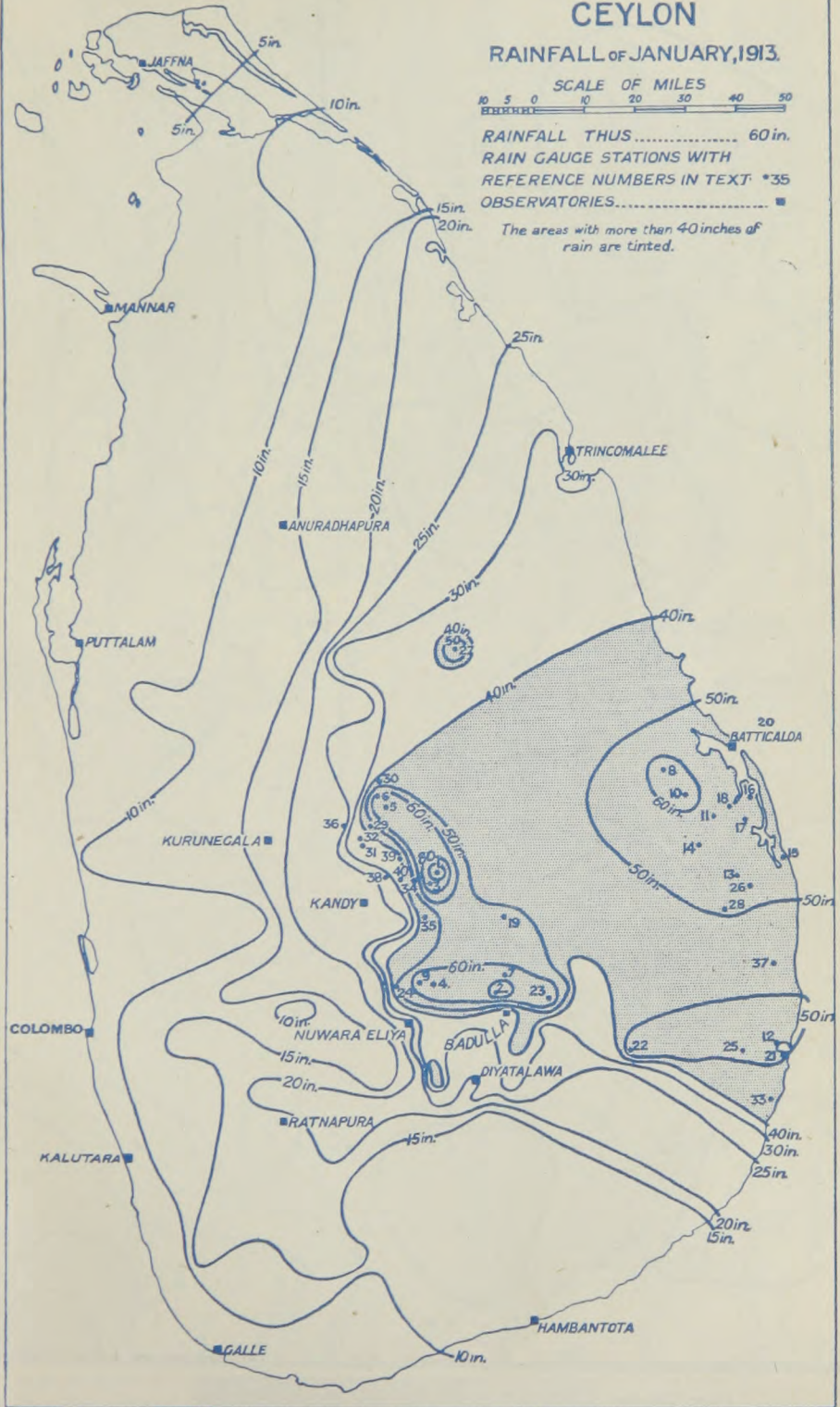
CEYLON

RAINFALL OF JANUARY, 1913.

SCALE OF MILES
10 5 0 10 20 30 40 50

RAINFALL THUS 60 in.
RAIN GAUGE STATIONS WITH
REFERENCE NUMBERS IN TEXT *35
OBSERVATORIES. ■

The areas with more than 40 inches of
rain are tinted.

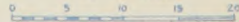


THAMES VALLEY RAINFALL — APRIL, 1913.



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

SCALE OF MILES



judged to some slight extent from a list of the previous highest rainfall totals recorded at the stations of the first class. It will be observed that, whilst one station only has failed to record a wetter month, no fewer than eight out of the sixteen never recorded so wet a January. The period over which the comparison extends is unfortunately not stated. It should be borne in mind that in a country presenting such an extraordinary variation in distribution of rainfall from place to place, these stations can by no means take full account of its possibilities from the point of view of heavy downpours, and much heavier falls in individual months have been recorded on some of the estates.

The following Table comprises a list of maximum falls within twenty-four hours exceeding 10 inches. It will be observed that the day of heaviest rainfall in most cases seems to have been the 17th, the date to which the note on p. 26 of the March number specially referred. The fall of 17·24 in. at Clodagh has to be added to those in Mr. Bamford's list, as it does not appear in the official tables. This station lies some 13 miles due north of Kandy, whilst Kobonella is in the immediate vicinity of the St. Martin's Estate, where the heaviest fall for the whole month was reported.

TABLE III.—*Rainfalls of 10 in. or more in 24 hours, January, 1913.*

| No. on Map. | STATION. | Altitude, feet. | in. | Date. |
|-------------|---------------------------------|-----------------|-------|-------|
| 1 | St. Martin's, Rangalla | 3600 | 24·78 | 16th |
| 3 | Kobonella, „ | 3300 | 18·80 | 17th |
| 6 | Gammaduwa, Rattota | 2400 | 16·40 | 17th |
| 5 | Dooroomadella, Gammaduwa | 2880 | 15·63 | 17th |
| 8 | Rugam | 77 | 15·10 | 9th |
| 12 | Rotawewa | 30 | 14·71 | 6th |
| 29 | Crystal Hill, Matale | 1400 | 14·07 | 17th |
| 30 | Sacumbe, Gammaduwa | 1200 | 13·87 | 16th |
| 10 | Unichchai | 120 | 13·82 | 9th |
| 31 | Wariapolla, Matale | 1200 | 13·01 | 16th |
| 32 | Matale | 1208 | 12·62 | 17th |
| 33 | Panawa | | 12·27 | 4th |
| 11 | Pollukannawa | | 12·09 | 9th |
| 34 | Duckwari, Rangalla | 3300 | 12·08 | 16th |
| 2 | Ledgerwatta, Badulla | 4000 | 12·00 | 6th |
| 18 | Manalpittyaar Anicut | 21 | 11·68 | 9th |
| 16 | Kadukkamunai | | 11·35 | 9th |
| 35 | Woodside, Urugalla | 3000 | 11·27 | 17th |
| 36 | Delwita, Kurunegala | 490 | 11·20 | 18th |
| 37 | Sakamam | 42 | 11·15 | 6th |
| — | Meeriatenne, Hanguranketa | 4450 | 11·09 | 17th |
| 13 | Veeragoda | 99 | 11·00 | 9th |
| 38 | Galphele, Wattegama | 2300 | 10·82 | 17th |
| 21 | Pottuvil | 10 | 10·67 | 6th |
| 39 | Elkaduwa | 2800 | 10·10 | 17th |
| 40 | Waragalanda, Madulkele | 2000 | 10·05 | 17th |
| 7 | Taldena | 1100 | 10·00 | 17th |

THE WEATHER OF APRIL.

DURING the early part of the month the conditions were dry generally, but with scanty sunshine except in Ireland. A deep depression moved in a southerly direction over Scotland and England during the 11th and this was accompanied by much rain, sleet and snow. Strong gales from some northerly point occurred in the north and eastern parts of the Kingdom and temperature remained low except in Ireland. In East Hertfordshire snow fell for 8 hours, and in East Essex it was by far the heaviest snowfall of the winter. Much damage was done to the young lambs, and all farm work was brought to a standstill. At Wirksworth snow was falling from 7.45 a.m. to 5.15 p.m. and the whole countryside was covered, while at Worstead (Norfolk) the fall lasted from about 4 p.m. to 11 p.m. In Glasgow and the west of Scotland shipyard and outdoor labour generally was interrupted while in the industrial areas of the north of England traffic was delayed and outdoor work suspended. Fair weather with low temperature followed for a few days but on the 15th a large and deep secondary depression appeared off the west coast and by evening caused strong winds and gales from the south over Ireland and the west of Scotland. Rain fell generally over the British Isles. During the latter half of the month rain fell almost daily in all parts excepting the extreme eastern counties, and local thunderstorms occurred in many places in the south of England. A considerable rise in temperature took place over Great Britain between the 22nd and 24th and most places recorded the highest temperature of the month on one of these days, although in Ireland temperature remained low. At Clifton and Cullompton the temperature rose to 68° on the 23rd and this was reached at Camden Square on the 24th. Along the North Sea coast 65° or above was reached and temperature was generally above 60° in Wales, the north-west of England and the west of Scotland. On the 25th snow fell to a depth of 2 inches at Cahir, Co. Tipperary. During the last few days the weather continued unsettled and temperature remained high, a reading of 70° being recorded at Margate on the 27th. On the 29th the temperature rose to 69° at Camden Square and in the evening severe thunderstorms occurred over the southern parts of England and the Midlands accompanied by heavy rain. The rainfall in the London area was rather less than .50 in. and it increased to the westward, over 1.00 in. falling at many stations in Oxfordshire and the bordering counties. At Culham College the fall was 1.93 in., at Bloxham Grove 1.49 in., and at Coventry 1.20 in. The track of heaviest rainfall on this day may be detected in the map of the rainfall of April over the Thames Valley, where a number of stations in a line running due north and south of Oxford will be seen to have reached a total of 4 inches for the month. The general rainfall of the great divisions of the Kingdom expressed as a percentage of the average was as follows:—England and Wales 180; Scotland 138; Ireland 153; British Isles 161.

ROYAL METEOROLOGICAL SOCIETY.

AN ORDINARY MEETING of the Society was held at the Surveyors' Institution, Great George Street, on April 16th, Mr. C. J. P. Cave, President, in the Chair.

Mr. W. H. Dines, F.R.S., read a paper on "The Vertical Distribution of Temperature in the Atmosphere, and the Work required to alter it." At the outset he stated the scope of his subject as follows: "It seems likely that the vertical distribution of temperature as we know it is the result of two opposing tendencies, one, the effect of radiation, the other the forced mixing produced by the general circulation, aided perhaps by the convection currents caused by the heating of the earth by solar radiation and by the latest heat set free by condensation." He compared the actual distribution with the possible alternatives, isothermal and adiabatic; the former the probable result of undisturbed radiation, the latter the effect of mixing. By considering the atmosphere as divided into a number of equal layers, and calculating the mean temperature of each, he showed that the amount of work required to change the distribution from isothermal to actual is comparatively small; the condensation of .16 in. of rain, supplies sufficient heat for the change. Col. Rawson initiated the discussion. Mr. Gold said that he did not agree that the result of undisturbed radiation would be an isothermal atmosphere; the amount of radiation absorbed and reflected was extremely indefinite.

Mr. J. E. Clark presented the Report of the Phenological Observations from December, 1911, to November, 1912, prepared by himself and Mr. R. H. Hooker. The flowers chosen as representative nearly all appeared before their average date except in the north and east of Scotland. The effect of the disastrous weather which was a feature of the latter half of the year was more apparent in the yield of farm crops, which was generally far below the average, both in quantity and quality.

A third paper on "Meteorological, Electrical and Magnetic Observations during the Solar Eclipse of April 17th, 1912," by Messrs. R. Corless, G. Dobson and Dr. C. Chree, F.R.S., was taken as read, but Dr. Chree gave a short account of the disturbances observed during the eclipse, and discussed their relation to that phenomenon. Meteorological observations generally showed well-pronounced results; the comparison of the sun's phase at South Kensington with the radiation was particularly striking. The potential gradient, as traced by the electrograph, exhibited no feature which could positively be attributed to the eclipse; a slight abnormal rise has its counterpart at the same hour on other days of the month. Magnetic observations showed a slightly steadying effect on the normal oscillations and a tendency to a decrease in the western declination.

The following new fellows were elected to the Society:—Messrs. E. J. Bolton, B. P. Jagtap, and E. G. Lamb, M.A.

INTERNATIONAL BALLOON ASCENTS.

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

September, 1910.

| Starting Point. | Country. | A miles. | B ° F. | C miles | D ° F. | E miles. | F |
|-------------------|--------------|-------------|-----------|------------|-----------|-------------|------------|
| Manchester | England ... | 8·1 | —79 | 10·7 | —70 | 161 | S.E. by E. |
| Brussels | Belgium .. | 6·6 | —56 | 9·6 | —62 | 74 | S.E. by E. |
| Hamburg | Germany .. | 6·0 | —65 | 7·3 | —54 | 25 | E.N.E. |
| Paris | France | 7·7 | —74 | 9·5 | —72 | 100 | S.E. by E. |
| Strassburg | Germany .. | 6·3 | —52 | 7·7 | —53 | 29 | E.S.E. |
| Munich | „ .. | 6·5 | —58 | 10·9 | —60 | 14 | S.S.E. |
| Vienna | Austria | 6·6 | —56 | 11·9 | ? | 17 | N.N.W. |
| Pavia | Italy | 7·2 | —51 | 10·7 | —58 | 68 | E.S.E. |
| Pavlovsk | Russia | 6·9 | —73 | 8·9 | —64 | 23 | W.S.W. |
| Nizhni Olchedaëff | „ | 7·2 | —63 | 10·6 | —53 | 30 | E.N.E. |

A Height in miles of commencement of isothermal column.

B Temperature, F°, at bottom of column.

C Greatest height of reliable record in miles.

D Temperature, F°, at greatest height.

E Distance in miles of point where balloon fell.

F Bearing of falling point from starting point.

The temperatures are fairly high, but early autumn is the time when the air from 1 to 6 miles high is at its warmest. The usual tendency towards greater uniformity at the highest point is plainly shown. High pressure areas lay over Finland and the Bay of Biscay, separated by a trough of low pressure over Denmark and North Germany, with minima over Iceland and the Mediterranean.

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MR. CAVE ON WINDS IN FREE AIR.

At the Royal Institution, on April 11th, Mr. C. J. P. Cave, President of the Royal Meteorological Society, lectured on “The Winds in the Free Air.”

Investigations were first carried out by means of kites, but these have been almost superseded by small balloons, with or without the meteorographs attached. For the purpose of studying air currents, the movements of the balloons are traced by means of a specially designed theodolite, and from these observations the direction and velocity of the winds in different air strata are calculated.

By means of an ingenious series of models the various wind structures were clearly demonstrated.

Generally speaking, the wind increases in velocity from the earth's surface to the level of the stratosphere, and then rapidly decreases; but this is by no means always the case. The different constructions were divided broadly into five classes. The first, which may be called “solid current,” consists of a wind of almost uniform velocity and constant direction for the whole depth of the troposphere. The second class is represented by winds increasing with height, the increase being sometimes very rapid. The third comprises chiefly

east winds, strong at the surface, but rapidly falling off and then giving way to a complete calm. The fourth is the ordinary case of reversal after a calm stratum. Sometimes the calm stratum is surmounted by a wind from the same direction as in the lower layers.

Mr. Cave said that he considered that possibly sustained thunderstorms could only take place when there was a wind reversal, so that masses of air of different electric potential were constantly being brought near together.

A reversal allows sounds to be heard at considerable distances in the direction of the upper wind, for the sound waves would be refracted downwards and reach the earth again at long distances from the point of origin. This possibly accounts for the idea that gun firing produces rain; the conditions favourable to the hearing of distant gun firing being also favourable to heavy rains.

In concluding, Mr. Cave said that it had been suggested by Dr. Shaw that the pressure changes which give rise to our weather, originate not near the earth's surface, as hitherto supposed, but just below the stratosphere; and that the study of the pressure distribution at that level might give most valuable results.

### METEOROLOGICAL NEWS AND NOTES.

THE ROYAL METEOROLOGICAL SOCIETY propose to hold their usual biennial dinner at the Trocadero Restaurant, Shaftesbury Avenue, Piccadilly Circus, W., on Tuesday evening, May 20th. The Council hope that the Fellows will take advantage of this opportunity of meeting representatives of other branches of science and of the public services.

BRITISH RAINFALL, 1911. Owing to the unusual demand for copies of "*British Rainfall, 1911*," the volume has, unfortunately, gone entirely out of print. Several Observers are still requiring copies in order to complete their sets, and, in the circumstances, it would be a great favour if any readers who have copies for which they have no further use would care to return them to the Editor at 62, Camden Square, London, N.W., in order that they may be passed on to those who have been unable to obtain them.

ONE OF THE EARLIEST WEATHER NOTES for England, later by a few years however than the famous Merle's MSS. Observations, was referred to in a letter from the Dean of Lichfield in the issue of *The Guardian*, for August 30th.

"Anno 1348 pluebat a festo nativitatis Iohannis Bapt. ad natale Domini, ita ut omni die vel nocte plueret."

The note occurs in a MS. copy of William Whitlocke's *Continuatio Historiæ Lichfeldensis*, which is preserved in the Lichfield Cathedral Library.

Whether the memorandum may be taken as evidence of climatic change or not, it suggests forcibly that the human tendency to exaggeration was as active in the writer of the fourteenth century as in the journalist of the twentieth.



## Correspondence.

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

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## THUNDERSTORMS ON APRIL 29th, 1913.

A THUNDERSTORM, of quite exceptional intensity, passed over this neighbourhood just after sunset on April 29th. The day throughout had been very close and humid with a marked diversity of air currents prevailing. Observations during the morning showed a high cirrus drift from S.E., with a second and lower drift from E., whilst cirro-cumulus and alto-stratus were travelling from S. and S.W. From 2 to 4 p.m. brilliant sunshine prevailed, but there was an ominous appearance of the sky to the S.E., inky blue black alto-stratus with cumulo-stratus (thunder heads), greatly intensified by the brilliant sunshine. Distant rolling thunder was first heard in S.E. at 5.55 p.m., the sky at this hour having become overcast with dense cirro-stratus, which had spread over rapidly from S.W., blue black alto-stratus still holding in S.E. Rolling thunder was heard at intervals of 3 to 5 minutes to 7.15 p.m., when the storm was moving up rapidly. At 7.25 p.m. vivid sheet lightning, red in colour, was first seen in S.E., the interval to thunder being 18 seconds. Fork lightning (white) was first seen at 7.29 p.m., being followed by thunder in 8 seconds. From 7.29 to 7.50 p.m. brilliant sheet and fork lightning prevailed, with time intervals to thunder varying between 8 and 5 seconds. Between 7.55 and 8 p.m. a count of the flashes yielded 35 sheet and 20 forked discharges, with 22 peals of thunder. At 8 p.m. cumulo-nimbus with a very extended range of front, accompanied by a heavy wind squall, and inky blackness, swept rapidly over the sky from a southerly point, the storm centre at this hour being practically at the zenith. At 8.2 p.m. lightning discharges were taking place at the rate of 15 per minute. The discharges were not of the nature of sudden flashes, but of quite appreciable duration, like a continuing flame, and lit up the landscape with a most weird effect. From 8.5 to 8.20 p.m. one incessant roll of thunder prevailed, the sheet and fork lightning flashes numbering 307 during this period, averaging 20 per minute. At 8.25 p.m. the storm was travelling away to the N. at a rapid rate, the time interval at this hour being 15 seconds, but with little, if any, decrease in the intensity of the lightning display. The last thunder was heard in N. at 8.50 p.m. At 10 p.m. there was still a bright display of sheet lightning to N., N.E. and N.W., averaging 10 flashes per minute, with an intermittent display prevailing to 12 p.m.

Steady rain fell from 7.40 to 8.10 p.m. amounting to .13 in., and heavier rain from 8.50 to 9.10 p.m., giving .22 in. The barograph showed a fall in pressure of 0.35 in. from 10 a.m. to 8 p.m., when there was a sudden increase amounting to 0.08 in.; being followed by a gradual fall, equal to the sudden increase, by 10 p.m.

In this neighbourhood, as a general rule, the storms follow the higher ground of the hills surrounding the Wealden area, circling the place of observation, but those storms which travel from a S.E. quadrant, across the Weald plain, on a northerly course, freed, at any rate for a time, from the influence of the South Downs, are invariably of exceptional intensity. SPENCER C. RUSSELL, F.R.Met.Soc.

*Southwater, Sussex, May 1st, 1913.*

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DURING the thunderstorm on the evening of April 29th, so rapidly did the flashes of lightning follow one another that we were induced to take note of their frequency. The storm reached here at about 7.20 p.m., but for some time previously we could hear it approaching from the S.W. In the five minutes, from 7.30 to 7.35 p.m., there were nineteen distinct flashes. Note was again taken from 7.43 till 8 p.m., during which period the storm was probably at its height, and 115 flashes of lightning were counted; the thunder being almost one continuous roar. Black clouds came up, their outer edge presenting an almost perfect line across the sky from S.E. to S.W., at 7.30 p.m., and gradually overspread the whole sky. In the fading daylight the effect of this and the vivid lightning was most weird. The rainfall was 0.54 in.

E. J. PLATT.

*The Gardens, Borden Wood, Liphook, Hants, May 7th, 1913.*

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WE had a very magnificent display of lightning here last night from 8 to 9 p.m. The thunder was nothing out of the way, but it was the finest lightning I have seen for years. Rain .51 in.

*Pyrton Hill, Oxon, April 30th, 1913.*

W. H. DINES.

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WE had a very bad thunderstorm yesterday, or rather, I believe, several storms round us simultaneously. The first rain fell at 6.30 p.m. Soon after 7 p.m. it became continuous and very heavy. Thunder and lightning began about the same time, and continued for two hours. For one hour, 7.30 p.m. to 8.30 p.m., the thunder was incessant with hardly a break in the rumbling, and the lightning was very frequent. The storms never seemed to pass over us, as there were no crackling claps of thunder. Owing to the hour, I was unable to watch the storm, except at intervals, when I was struck with the red or pink colour of the lightning as it lit up the darkness with a shimmering glow, sometimes showing a white or yellow snaky streak on the clouds. I noticed one blue flash. The wind was, I think, from S.E., and very high and gusty at first. The rain ceased shortly before 10 p.m., but at 10.20 p.m. there was another very short and sharp fall. We measured 1.33 in. this morning, the

biggest fall in April that I have seen ; though possibly 1·01 in. on April 16th, 1910, of which ·75 in. fell in one hour, may have been heavier. I do not think it rained again after 10.30 p.m.

62, Banbury Road, Oxford, April 30th, 1913. E. M. TAWNEY.

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A HEAVY thunderstorm broke over this village last evening. The day had been cloudy with a south-east wind, changing to due east at about 3 p.m. About 6.40 p.m. a shower of rain came on, it then cleared for a few minutes, and at 7 p.m. it was falling fast again, and kept on till 9.30 p.m. Thunder was heard at 7.15 p.m., and died away about 9.20 p.m. From 7.55 p.m. to 8.10 p.m. there was no interval between the thunder claps, and there was a continual roar. The thunder all through the storm was loud and frequent, with an alarming clap right overhead at 8.25 p.m. The wind this morning is south-west and fresh. Rainfall registered this morning ·90 in.

Swerford, Oxford, April 30th, 1913. WM. HALL.

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### THUNDERSTORM AND BLACK RAIN.

WE had rather a severe thunderstorm just over us on May 2nd. It began at about 2 p.m. and remained overhead, or within about a mile, till about 3.15 p.m. It was not incessant, but stopped and seemed as if it was going away, and then began again. During the time we had ·45 in. of rain which fell very heavily at times. The peculiarity about the rain was that it was black and dirty, the water out of the gauge being sooty. I noticed also that the pool of water in front of the house, which had run down the hill, was quite black. The tubs of water, too, were the same. The cottage people thought it was dirt off their roofs ; it was the same in some of the adjoining villages. The water this morning, after heavy rain, was all right.

Another peculiarity after the storm was the number of worms crawling about the roads and paths. This morning, too, the roads and paths were full of worms crawling about ; I never saw such numbers before. Is this not very unusual ?

H. I. KILNER.

Little Saxham Rectory, Bury St. Edmunds, May 4th.

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### AN EXAMPLE OF PUBLIC SPIRIT.

IN a recent letter to a Torquay paper, it was suggested that Torquay should have a good public barograph, now an essential at watering places. On reading the letter, Sir Thomas Bazley, Bart., of Kilmorie, near here, promptly and generously presented a first-class instrument (of French make) to the town. An admirable example, deserving to be made widely known. *O si sic omnes !*

A.B.M.

Hollocombe, Torre, 9th May, 1913.

### METEOROLOGICAL NOMENCLATURE.

ON page 53 of your April number, in the review of Mr. Lempfert's book your reviewer states that the term isothermal column is "ambiguous or even misleading." I cannot agree with this view. Isothermal layer is misleading, but isothermal column, applied as it always is, so far as I know, to the upper air over the place of observation, is perfectly accurate. In nearly all cases the change of temperature in a vertical direction is trifling. Dr. Shaw's statement is (M.O. 202, p. 48) "the thermal structure instead of being stratified is columnar." Now the term stratosphere appears to me to imply stratification, which as it happens prevails in the lower part called the troposphere, but does not occur in the so-called stratosphere. The term "stratosphere" is, therefore, more misleading than the term "isothermal layer," which does give a certain idea of the facts, and far more so than isothermal column, which, when applied locally, and the term column is essentially local, truly represents the facts.

"A rose by any other name would smell as sweet"; the terms troposphere and stratosphere are single words and, therefore, convenient, but the chief ground for adopting them seems to me to be that they were proposed by Teisserenc de Bort, who discovered the phenomena they represent.

Could anyone think of more truly descriptive words it would now be too late, but a single word is badly wanted to express the height for which the symbol  $H_e$  or  $H_i$  is commonly employed.

*Pyrlton Hill, Oxon, April 22nd, 1913.*

W. H. DINES.

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### SUNSHINE AND RAIN OF PAST TWELVE MONTHS.

THE duration of sunshine and the rainfall here for the past twelve months seem sufficiently remarkable to be worthy of notice. During the Calendar Year 1912 only 944 hours of sunshine were recorded, which is 312 hours less than the average of the 30 years 1881-1910, and 121 hours less than in 1888, which was, up to then, the dullest year. The rainfall for the year was 33.45 in., which is 9.13 in., or 38 per cent. above the average of the 35 years 1876-1910 and was only exceeded in 1880, when the total was 34.94 in. But 1912 had one bright spot, the month of April, with a rainfall of only .14 in. and an excess of sunshine of 55 hours. During the first four months of 1913 the general character of 1912 was continued, dull and wet, with the result that for the twelve months May, 1912, to April, 1913, the sunshine has only totalled 874 hours, a deficiency of 382 hours, while the rainfall amounts to 34.70 in., an excess of 10.38 in. No month of the period has had an average amount of sunshine; August and November were the dullest of their names in the record, while July, December, and January were the dullest, with one exception.

*Hodsock Priory, Worksop, May 3rd, 1913.*

HENRY MELLISH.

## THE MOON AND THE WEATHER.

By F. W. HENKEL, B.A., F.R.A.S.

It has long been a popular notion that an intimate connection exists between the changes of appearance, or phases, of the moon and weather changes, and the literature of all nations abounds in allusions to this belief. Notwithstanding the progress of science and the evidence of countless observations tending to negative the existence of any but the most minute influence of our satellite upon terrestrial weather conditions, this belief is tenaciously held by many persons, sailors and travellers amongst others, who, by a free use of the argument *post hoc ergo propter hoc*, find reasons for the faith that is in them. It seems probable that the only basis for all this lies in the fact that the four "changes" of the moon, New, First Quarter, Full, and Last Quarter, recurring at intervals of rather less than  $7\frac{1}{2}$  days, *all* changes of the weather must occur within three or four days on one side or the other of each of these changes, whilst many are bound to happen at shorter intervals of time. Then by noting only such changes and ignoring the rest it is easy to establish any desired relation, with the certainty that such a method will enable us to prove, if need be, that the moon brings rain here, thunder in North Africa, wind in India, snow in Japan, etc.

But the *total* amount of light and heat received by us from the moon is so small that only within recent years has it been possible to measure roughly these quantities at all. The late Lord Rosse, by the help of his telescopes and delicate instruments, approximately determined the fraction of heat sent by the full moon as about one *eighty-thousandth part* of that sent by the sun, whilst the most generous estimate for its light gives the fraction of  $\frac{1}{300,000}$  that of sunlight. The estimate of Zöllner is only one-half this, *i.e.*,  $\frac{1}{618,000}$  that is to say "if the whole visible hemisphere of the sky were packed with full moons we should receive from it about one-eighth part of the light of the sun." Such is the total amount, yet it is changes in this minute quantity which, according to some weather prophets, are potent in producing weather changes. The differential gravitational action of the moon produces atmospheric tides in the ocean of air, just as tides are produced in the waters, but the maximum effect of this action upon the barometer has been estimated at less than 0.003 in. of mercury, or about one ten-thousandth of an atmosphere, a quantity completely masked by almost every other cause of change. In every case the whole moon is always present, it is merely a question of the greater or less visibility of its surface turned towards us producing the gradual changes of appearance, four distinct stages of which are known by special names, New Moon, when none of the illuminated surface is visible; Full Moon when all is turned towards us; First and Last Quarters when exactly one half is illuminated, the other half in darkness.

There exist a number of prognostics, drawn from the position of the horns of the crescent moon when first seen after new, bearing upon the weather immediately following. It need hardly be said that the position of these cusps, as they are called, is absolutely definite and predictable in advance, being always perpendicular to the line joining the sun and moon, and so were it the case that this position had an influence on weather conditions we should possess an additional potent aid in forecasting.

The old saying, "moon lying on her back" followed always by wind, rain and other bad weather, is alluded to by an early writer in *Symons's Meteorological Magazine* many years ago (1867), so perhaps the repetition may be permitted now—

“ When the moon lies on her back  
Then the sou'-west wind will crack,  
When she rises up and nods  
Then north-easters dry the sods.”

Lord Bacon, “wisest and meanest of mankind,” to whose credit has been laid much of which he was entirely innocent, notwithstanding his enlightened love for science and the valuable aphorisms of the *Novum Organum*, appears to have been a firm believer in astrology, and quoted with approval weather-saws of scarcely greater value, says of the appearance of the moon, “if at her birth or within the first few days the lower horn of the moon appear obscure, dark or in any way discoloured, there will be foul and stormy weather before the full. If she be discoloured in the middle it will be stormy about the full, but if the upper horn is thus affected, about the wane.” Very detailed information, but scarcely obtained by the “inductive method”! He says also, “An erect moon is almost always threatening and unfavourable, but principally denotes wind. If, however, she appears with blunt or shortened horns it is rather a sign of rain.” (Inwards’ “Weather Lore.”)

A detailed list of weather changes following the phases of the moon has been compiled for the United States (it is not stated whether the same weather conditions are to be expected throughout the whole of that vast area, or perhaps the prophet meant only New York and its neighbourhood), wherein we are told, if the moon “changes” in summer between 12 and 2 a.m. the weather will be fair, if between 2 and 4 a.m. “cold and showery,” if the change come between 4 and 6 a.m. there will be rain. For the same hours we learn that in winter the moon changing between 12 and 2 a.m. frost follows, unless the wind is S.W., if the change takes place between 2 and 4 a.m. there will be snow and stormy weather, if between 4 and 6 a.m. rain is to be expected. A Spanish proverb, “said to be correct nine times out of twelve,” says, “If the weather on the sixth day (after new moon) is the same as that on the fourth day, the same weather will continue during the whole lunation,” and a similar saying is stated to be current in France also.

The phenomenon of "earth shine," or "old moon in the new moon's arm," *i.e.*, the part of the disc unilluminated by direct sunlight being faintly visible by twice-reflected light from the Earth, often seen three or four days after new moon, has been variously regarded as a prognostic of bad weather or good, according to the district where the saying is current. Thus we learn that to see the old moon in the arms of the new one is a sign of bad weather to come.

"Late, late yestreen, I saw the new moone  
Wi' the auld moone in her ain,  
And I feir, I feir, my deir master,  
That we will come to harme."—*Percy Reliques*.

On the other hand, the Suffolk proverb says, "To see the old moon in the new moon's arms is reckoned a sign of fair weather," and so is the turning up of the horns of the new moon. Swainson says:—"In this position it is supposed to retain the water which is in it."

With regard to the supposed clearing action of the full moon on clouds, alluded to by Dr. Shaw in his recent work, "Forecasting Weather" (p. 175), expressed by the nautical saying, "the full moon eats clouds," or its French equivalent, "*la lune mange les nuages*," though the late Sir John Herschel and other high authorities inclined to believe in its genuineness, most meteorologists are of opinion that this is an illusion. It does not seem easy to understand how the minute, almost infinitesimal, amount of heat radiated by the moon can *produce* any such effect. Dr. Shaw's explanation that it is *post hoc* but *not propter hoc* may here be given. "A single layer of drifting fleecy clouds—detached stratus—is *rendered visible* by the illumination of the moon not very long after sunset. The illumination not only shows the clouds, but shows that they are diminishing, and finally the moon is left in possession of an unusually clear sky."

The appearance of halos and coronæ round sun and moon stands on a somewhat higher level as a genuine weather sign, so that it need scarcely be alluded to here. From time to time, on the appearance of remarkable comets, attempts have been made to ascertain possible connections between these phenomena and weather.

Of a somewhat different character is the question of influence of sunspots upon terrestrial weather conditions, a subject upon which a good deal has been written from time to time, but unfortunately most of this has been too evidently coloured by personal feeling rather than by dispassionate scientific statement. The sun is so evidently the prime mover in almost every terrestrial phenomenon, and his connection with variations in terrestrial magnetism, auroral frequency, etc., has been so clearly shown as the result of direct observation, that it must seem *prima facie* highly probable that the disturbances on or within his surface indicated by the spottedness of the latter cannot be without effect upon terrestrial weather con-

ditions. The eleven-year cycle and longer periods suspected by Schuster and others, it is thought, must find their reflection in variations of temperature, rainfall, pressure, etc., at terrestrial stations.

Unfortunately, we are by no means certain, in the first place, whether the sun is hotter or no at the time of sunspot maximum than at the time of minimum, the intervals between one maximum and the next, though having the average value of 11 years, are sometimes as great as 16 years and sometimes shorter than 8 years apart; and though the spots are the most prominent and rapidly changing features of the surface, they are not necessarily signs of the perhaps more important internal changes. On the other side, so far as any comparison between solar spottedness and terrestrial weather conditions has yet been made, the results are most conflicting and contradictory for different stations. In one place it would seem that there is more rain at the time of maximum spottedness, at other the reverse is the case. Some meteorological records of Argentina appear to favour a connection between wind currents and the number of sunspots. But on the whole we may agree that the investigation of the late Editor of *Symons's Met. Mag.*, in the course of which he examined an immense number of rainfall statistics, and arrived at a negative result, have not been superseded (*Nature*, Vol. 7, pp. 143-5). The attempts of some persons to establish a yet more intimate connection between sunspots and commercial crises, etc., may well be classed under the heading of fallacies even more inexcusable than those associated with the moon and weather, because their authors were men who should have known better. The institution and successful working of Solar Observatories, now in action or in course of erection all over the world, will supply material perhaps more than can be conveniently dealt with in the present state of meteorological science; but attempts to deal with it on preconceived hypotheses of connection with terrestrial phenomena may lead to almost any results the statisticians desire. The successful prediction of *future* weather conditions, however, is quite another matter.

The "fixed" stars, notwithstanding their remoteness, have also been associated with changes of weather. We learn from Aratus that:—

"The prudent mariner oft marks afar  
The coming tempest by Boötes star" (Arcturus).

and Theophrastus says that, if it does not rain at the rising of Sirius and Arcturus, there will generally be *rain or wind about the equinox*, a prediction not wanting in its generality with regard to time and place.

Bacon says: "Rain and showers follow upon the rising of the Pleiades and Hyades, but without wind; storms upon the rising of Orion and Arcturus."

[NOTE.—For some of the quotations given we are indebted to Mr. R. Inward's "Weather Lore."]



## RAINFALL TABLE FOR APRIL, 1913.

| 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. | 1913.<br>in. |
| Camden Square.....                   | London.....          | 51 32      | 0 8                  | 111                            | 1'74                           | 2'72         |
| Tenterden.....                       | Kent.....            | 51 4       | *0 41                | 190                            | 1'77                           | 2'87         |
| Arundel (Patching).....              | Sussex.....          | 50 51      | 0 27                 | 130                            | 1'82                           | 3'10         |
| Fawley (Cadland).....                | Hampshire.....       | 50 50      | 1 22                 | 52                             | 1'98                           | 3'55         |
| Oxford (Magdalen College).....       | Oxfordshire.....     | 51 45      | 1 15                 | 186                            | 1'67                           | 3'06         |
| Wellingborough (Croyland Abbey)..... | Northampton.....     | 52 18      | 0 41                 | 174                            | 1'78                           | 2'37         |
| Shoeburyness.....                    | Essex.....           | 51 31      | *0 48                | 13                             | 1'25                           | 2'19         |
| Bury St. Edmunds (Westley).....      | Suffolk.....         | 52 15      | *0 40                | 226                            | 1'62                           | 2'33         |
| Geldeston [Beccles].....             | Norfolk.....         | 52 27      | *1 31                | 38                             | 1'55                           | 1'88         |
| Polapit Tamar [Launceston].....      | Devon.....           | 50 40      | 4 22                 | 315                            | 2'34                           | 5'12         |
| Rousdon [Lyme Regis].....            | ".....               | 50 41      | 3 0                  | 516                            | 2'39                           | 3'17         |
| Stroud (Upheld).....                 | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 2'09                           | 3'78         |
| Church Stretton (Wolstaston).....    | Shropshire.....      | 52 35      | 2 48                 | 800                            | 2'20                           | 5'49         |
| Coventry (Kingswood).....            | Warwickshire.....    | 52 24      | 1 30                 | 340                            | 1'96                           | 3'70         |
| Boston.....                          | Lincolnshire.....    | 52 58      | 0 1                  | 11                             | 1'57                           | 1'90         |
| Worksop (Hodsock Priory).....        | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 1'62                           | 2'34         |
| Macclesfield.....                    | Cheshire.....        | 53 15      | 2 7                  | 501                            | 2'02                           | 3'84         |
| Southport (Hesketh Park).....        | Lancashire.....      | 53 38      | 2 59                 | 38                             | 1'84                           | 3'06         |
| Arncliffe Vicarage.....              | Yorkshire, W.R.....  | 54 8       | 2 6                  | 732                            | 3'73                           | 7'76         |
| Wetherby (Ribston Hall).....         | ".....               | 53 59      | 1 24                 | 130                            | 1'85                           | 2'81         |
| Hull (Pearson Park).....             | "..... E.R.....      | 53 45      | 0 20                 | 6                              | 1'69                           | 1'69         |
| Newcastle (Town Moor).....           | Northumberland.....  | 54 59      | 1 38                 | 201                            | 1'84                           | 2'59         |
| Borrowdale (Seathwaite).....         | Cumberland.....      | 54 30      | 3 10                 | 423                            | 6'91                           | 14'11        |
| Cardiff (Ely).....                   | Glamorgan.....       | 51 29      | 3 13                 | 53                             | 2'50                           | 5'53         |
| Haverfordwest.....                   | Pembroke.....        | 51 48      | 4 58                 | 90                             | 2'82                           | 4'84         |
| Aberystwyth (Gogerddan).....         | Cardigan.....        | 52 26      | 4 1                  | 83                             | 2'48                           | 6'80         |
| Llandudno.....                       | Cardarvon.....       | 53 20      | 3 50                 | 72                             | 1'79                           | 3'16         |
| Cargen [Dumtries].....               | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 2'50                           | 6'02         |
| Marchmont House.....                 | Berwick.....         | 55 44      | 2 24                 | 498                            | 2'28                           | 2'55         |
| Girvan (Pinmore).....                | Ayr.....             | 55 10      | 4 49                 | 207                            | 2'81                           | 4'49         |
| Glasgow (Queen's Park).....          | Renfrew.....         | 55 53      | 4 18                 | 144                            | 1'86                           | 2'93         |
| Inveraray (Newtown).....             | Argyll.....          | 56 14      | 5 4                  | 17                             | 3'69                           | 4'83         |
| Mull (Quinish).....                  | ".....               | 56 34      | 6 13                 | 35                             | 2'98                           | 5'16         |
| Dundee (Eastern Necropolis).....     | Forfar.....          | 56 28      | 2 57                 | 199                            | 1'93                           | 1'96         |
| Braemar.....                         | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | 2'30                           | 3'46         |
| Aberdeen (Cranford).....             | ".....               | 57 8       | 2 7                  | 120                            | 2'23                           | 3'00         |
| Cawdor.....                          | Nairn.....           | 57 31      | 3 57                 | 250                            | 1'62                           | 1'20         |
| Fort Augustus (S. Benedict's).....   | E. Inverness.....    | 57 9       | 4 41                 | 68                             | 2'22                           | 2'76         |
| Loch Torridon (Bendamph).....        | W. Ross.....         | 57 32      | 5 32                 | 20                             | 4'70                           | 6'40         |
| Dunrobin Castle.....                 | Sutherland.....      | 57 59      | 3 56                 | 14                             | 2'02                           | 2'00         |
| Wick.....                            | Caithness.....       | 58 26      | 3 6                  | 77                             | 1'89                           | 1'43         |
| Killarney (District Asylum).....     | Kerry.....           | 52 4       | 9 31                 | 178                            | 3'46                           | 4'43         |
| Waterford (Brook Lodge).....         | Waterford.....       | 52 15      | 7 7                  | 104                            | 2'68                           | 4'61         |
| Nenagh (Castle Lough).....           | Tipperary.....       | 52 54      | 8 24                 | 120                            | 2'54                           | ...          |
| Ennistymon House.....                | Clare.....           | 52 57      | 9 18                 | 37                             | 2'81                           | 3'73         |
| Gorey (Courtown House).....          | Wexford.....         | 52 40      | 6 13                 | 80                             | 2'37                           | 3'09         |
| Abbey Leix (Blandsfort).....         | Queen's County.....  | 52 56      | 7 17                 | 532                            | 2'54                           | 4'52         |
| Dublin (Fitz William Square).....    | Dublin.....          | 53 21      | 6 14                 | 54                             | 2'03                           | 2'76         |
| Mullingar (Belvedere).....           | Westmeath.....       | 53 29      | 7 22                 | 367                            | 2'37                           | 4'33         |
| Crossmolina (Enniscoe).....          | Mayo.....            | 54 4       | 9 16                 | 74                             | 3'13                           | 4'82         |
| Cong (The Glebe).....                | ".....               | 53 33      | 9 16                 | 112                            | 2'98                           | 3'99         |
| Collooney (Markree Obsy.).....       | Sligo.....           | 54 11      | 8 27                 | 127                            | 2'52                           | 4'27         |
| Seaforde.....                        | Down.....            | 54 19      | 5 50                 | 180                            | 2'76                           | 3'78         |
| Bushmills (Dundarave).....           | Antrim.....          | 55 12      | 6 30                 | 162                            | 2'08                           | 3'46         |
| Omagh (Edenfel).....                 | Tyrone.....          | 54 36      | 7 18                 | 280                            | 2'50                           | 4'44         |

## RAINFALL TABLE FOR APRIL, 1913—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.      | 1913. | Diff. from Aver. in. | % of Av. |                        |                 |
|                          |          | in.               | Date.  |             | in.                   | in.   |                      |          | in.                    |                 |
| + .98                    | 156      | .48               | 11     | 21          | 6.93                  | 8.37  | +1.44                | 121      | 25.11                  | Camden Square   |
| +1.10                    | 162      | .54               | 3      | 19          | 7.76                  | 11.05 | +3.29                | 142      | 27.64                  | Tenterden       |
| +1.28                    | 170      | .45               | 11     | 17          | 8.53                  | 13.08 | +4.55                | 153      | 30.48                  | Patching        |
| +1.57                    | 179      | 1.35              | 30     | 18          | 9.18                  | 13.07 | +3.89                | 142      | 31.87                  | Cadland         |
| +1.39                    | 183      | 1.10              | 29     | 19          | 6.52                  | 8.72  | +2.20                | 134      | 24.58                  | Oxford          |
| + .59                    | 133      | .56               | 29     | 18          | 7.05                  | 9.31  | +2.26                | 132      | 25.17                  | Croyland Abbey  |
| + .94                    | 175      | .50               | 11     | 14          | 4.96                  | 6.49  | +1.53                | 131      | 19.28                  | Shoeburyness    |
| + .71                    | 144      | .57               | 29     | 15          | 6.62                  | 7.57  | + .95                | 114      | 25.40                  | Westley         |
| + .33                    | 122      | .52               | 30     | 16          | 6.06                  | 7.03  | + .97                | 116      | 23.73                  | Geldeston       |
| +2.78                    | 218      | 1.11              | 26     | 22          | 11.62                 | 19.28 | +7.66                | 166      | 38.27                  | Polapit Tamar   |
| + .78                    | 133      | .42               | 20     | 18          | 10.13                 | 13.85 | +3.72                | 137      | 33.54                  | Rousdon         |
| +1.69                    | 181      | .64               | 15     | 17          | 8.55                  | 13.66 | +5.11                | 160      | 29.81                  | Stroud          |
| +3.29                    | 249      | 1.13              | 26     | 21          | 9.07                  | 16.44 | +7.37                | 181      | 32.41                  | Wolstaston      |
| +1.74                    | 189      | 1.20              | 29     | 16          | 8.08                  | 13.22 | +5.14                | 164      | 28.98                  | Coventry        |
| + .33                    | 121      | .50               | 11     | 20          | 6.11                  | 7.64  | +1.53                | 125      | 23.35                  | Boston          |
| + .72                    | 144      | .49               | 11     | 17          | 6.66                  | 8.80  | +2.14                | 132      | 24.46                  | Hodsock Priory  |
| +1.82                    | 190      | .76               | 29     | 17          | 9.48                  | 12.91 | +3.43                | 136      | 34.73                  | Macclesfield    |
| +1.22                    | 166      | .69               | 15     | 18          | 8.57                  | 11.43 | +2.86                | 134      | 32.70                  | Southport       |
| +4.03                    | 208      | 1.33              | 15     | 18          | 20.04                 | 30.80 | +10.76               | 154      | 61.49                  | Arnccliffe      |
| + .96                    | 152      | .47               | 30     | 19          | 7.37                  | 9.06  | +1.69                | 123      | 26.87                  | Ribston Hall    |
| + .00                    | 100      | .50               | 11     | 18          | 7.01                  | 8.55  | +1.54                | 122      | 26.42                  | Hull            |
| + .75                    | 141      | .51               | 28     | 13          | 7.47                  | 10.98 | +3.51                | 147      | 27.94                  | Newcastle       |
| +7.20                    | 204      | 3.58              | 15     | 19          | 41.94                 | 56.54 | +14.60               | 135      | 129.48                 | Seathwaite      |
| +3.03                    | 222      | 1.63              | 15     | 18          | 12.11                 | 20.63 | +8.52                | 170      | 42.28                  | Cardiff         |
| +2.02                    | 172      | 1.25              | 15     | 20          | 14.09                 | 21.39 | +7.30                | 152      | 46.81                  | Haverfordwest   |
| +4.32                    | 274      | 1.33              | 15     | 19          | 12.52                 | 21.27 | +8.75                | 170      | 45.46                  | Gogerddan       |
| +1.37                    | 177      | .47               | 29     | 19          | 8.54                  | 11.35 | +2.81                | 133      | 30.36                  | Llandudno       |
| +3.52                    | 241      | 1.66              | 15     | 19          | 13.35                 | 21.00 | +7.65                | 157      | 43.47                  | Cargen          |
| + .27                    | 112      | .44               | 28     | 14          | 9.47                  | 10.13 | + .66                | 107      | 33.76                  | Marchmont       |
| +1.68                    | 160      | .68               | 11, 26 | 19          | 15.08                 | 17.59 | +2.51                | 117      | 49.77                  | Girvan          |
| +1.07                    | 157      | .59               | 15     | 18          | 10.70                 | 13.80 | +3.10                | 129      | 35.97                  | Glasgow         |
| +1.14                    | 131      | .61               | 26     | 22          | 22.15                 | 25.93 | +3.78                | 117      | 68.67                  | Inveraray       |
| +2.18                    | 173      | .71               | 24     | 17          | 17.26                 | 22.45 | +5.19                | 130      | 56.57                  | Quinish         |
| + .03                    | 102      | .41               | 29     | 12          | 7.91                  | 9.63  | +1.72                | 122      | 28.64                  | Dundee          |
| +1.16                    | 150      | .61               | 15     | 15          | 10.64                 | 14.94 | +4.30                | 140      | 34.93                  | Braemar         |
| + .77                    | 134      | .70               | 28     | 14          | 9.60                  | 10.70 | +1.10                | 111      | 32.73                  | Aberdeen        |
| - .42                    | 74       | .32               | 11     | 9           | 8.31                  | 7.26  | -1.05                | 87       | 29.33                  | Cawdor          |
| + .54                    | 124      | .60               | 16     | 16          | 15.79                 | 18.19 | +2.40                | 115      | 44.53                  | Fort Augustus   |
| +1.70                    | 136      | 1.22              | 15     | 15          | 28.94                 | 31.78 | +2.84                | 110      | 83.93                  | Bendamph        |
| - .02                    | 99       | .40               | 11     | 12          | 9.99                  | 6.35  | -3.64                | 64       | 31.90                  | Dunrobin Castle |
| - .46                    | 76       | .51               | 28     | 16          | 8.84                  | 7.07  | -1.77                | 80       | 29.88                  | Wick            |
| + .97                    | 128      | .91               | 15     | 22          | 18.90                 | 23.95 | +5.05                | 127      | 54.81                  | Killarney       |
| +1.93                    | 172      | 1.04              | 29     | 17          | 12.28                 | 17.72 | +5.44                | 144      | 39.57                  | Waterford       |
| ...                      | ...      | ...               | ...    | ...         | 12.30                 | ...   | ...                  | ...      | 39.43                  | Castle Lough    |
| + .92                    | 133      | .61               | 15     | 21          | 13.79                 | 18.70 | +4.91                | 136      | 46.52                  | Ennistymon      |
| + .72                    | 130      | .59               | 29     | 15          | 10.59                 | 14.96 | +4.37                | 141      | 34.99                  | Courtown Ho.    |
| +1.98                    | 178      | 1.00              | 29     | 22          | 10.83                 | 16.47 | +5.64                | 152      | 35.92                  | Abbey Leix      |
| + .73                    | 136      | .85               | 29     | 19          | 8.08                  | 11.10 | +3.02                | 137      | 27.68                  | Dublin          |
| +1.96                    | 183      | .78               | 29     | 20          | 10.78                 | 16.05 | +5.27                | 149      | 36.15                  | Mullingar       |
| +1.69                    | 154      | 1.07              | 15     | 22          | 17.04                 | 24.23 | +7.19                | 142      | 52.87                  | Enniscoe        |
| +1.01                    | 134      | .71               | 15     | 21          | 15.29                 | 22.45 | +7.16                | 147      | 48.90                  | Cong            |
| +1.75                    | 169      | .50               | 15     | 21          | 12.92                 | 18.43 | +5.51                | 143      | 42.71                  | Markree         |
| +1.02                    | 137      | .77               | 29     | 18          | 11.82                 | 15.02 | +3.20                | 127      | 38.91                  | Seaforde        |
| +1.38                    | 166      | .48               | 18     | 20          | 10.56                 | 10.32 | - .24                | 98       | 37.56                  | Dundarave       |
| +1.94                    | 177      | .65               | 18     | 22          | 11.62                 | 15.65 | +4.03                | 135      | 39.38                  | Omagh           |

## SUPPLEMENTARY RAINFALL, APRIL, 1913.

| Div.  | STATION.                      | Rain<br>inches | Div.   | STATION.                      | Rain<br>inches |
|-------|-------------------------------|----------------|--------|-------------------------------|----------------|
| II.   | Warlingham, Redvers Road..    | 3.50           | XI.    | Lligwy .....                  | 2.98           |
| „     | Ramsgate .....                | 2.14           | „      | Douglas .....                 | ...            |
| „     | Hailsham .....                | 4.20           | XII.   | Stoneykirk, Ardwell House...  | 3.13           |
| „     | Totland Bay, Aston House...   | 2.68           | „      | Dalry, The Old Garroch.....   | 5.50           |
| „     | Stockbridge, Ashley.. .....   | 3.00           | „      | Beattock, Kinnelhead .....    | 7.32           |
| „     | Grayshott .....               | 3.45           | „      | Langholm, Drove Road .....    | 5.99           |
| „     | Caversham, Rectory Road ...   | 2.68           | XIII.  | Meggat Water, Cramilt Lodge   | 6.25           |
| III.  | Harrow Weald, Hill House...   | 2.80           | „      | North Berwick Reservoir.....  | 1.66           |
| „     | Pitsford, Sedgebrook.....     | 2.50           | „      | Edinburgh, Royal Observatry.  | 1.79           |
| „     | Woburn, Milton Bryant.....    | 2.52           | XIV.   | Maybole, Knockdon Farm ...    | 2.63           |
| „     | Chatteris, The Priory.....    | 1.57           | XV.    | Ballachulish House .....      | 7.72           |
| IV.   | Colchester, Hill Ho., Lexden  | 2.20           | „      | Campbeltown, Witchburn ..     | 4.76           |
| „     | Newport, Belmont House ...    | 1.94           | „      | Holy Loch, Ardnadam .....     | 5.41           |
| „     | Ipswich, Rookwood, Copdock    | 2.15           | „      | Islay, Eallabus .....         | 4.70           |
| „     | Blakeney .....                | 1.39           | „      | Tiree, Cornaigmore .....      | 4.76           |
| „     | Swaffham .....                | 2.39           | XVI.   | Dollar Academy .....          | 2.86           |
| V.    | Bishops Cannings .....        | 3.13           | „      | Balquhider, Stronvar.....     | 7.16           |
| „     | Winterbourne Steepleton.....  | ...            | „      | Glenlyon, Meggernie Castle..  | 6.92           |
| „     | Ashburton, Druid House .....  | 7.53           | „      | Blair Atholl .....            | 3.15           |
| „     | Cullompton .....              | 4.19           | „      | Coupar Angus .....            | 2.22           |
| „     | Lynmouth, Rock House ...      | 5.82           | „      | Montrose, Sunnyside Asylum.   | 2.88           |
| „     | Okehampton, Oaklands.....     | 5.73           | XVII.  | Alford, Lynturk Manse .....   | 2.22           |
| „     | Hartland Abbey.....           | 4.55           | „      | Fyvie Castle .....            | 1.58           |
| „     | Probus, Lamellyn.....         | 3.26           | „      | Keith Station .....           | 2.07           |
| „     | North Cadbury Rectory.....    | 2.76           | XVIII. | Alvey Manse.....              | 1.79           |
| VI.   | Clifton, Pembroke Road.....   | 3.10           | „      | Loch Quoich, Loan .....       | 10.85          |
| „     | Ross, The Graig .....         | 4.02           | „      | Drumadrochit .....            | 2.07           |
| „     | Shifnal, Hatton Grange.....   | 3.17           | „      | Skye, Dunvegan .....          | 5.83           |
| „     | Droitwich .....               | 3.31           | „      | N. Uist, Lochmaddy .....      | ...            |
| „     | Blockley, Upton Wold.....     | 3.69           | „      | Glencarron Lodge .....        | 5.54           |
| VII.  | Market Overton.....           | 2.59           | XIX.   | Invershin .....               | 1.84           |
| „     | Market Rasen.....             | 2.18           | „      | Melvich .....                 | 1.21           |
| „     | Bawtry, Hesley Hall .....     | 2.07           | „      | Loch Stack, Ardochullin ..... | 2.68           |
| „     | Derby, Midland Railway.....   | 3.21           | XX.    | Skibbereen Rectory .....      | 5.84           |
| „     | Buxton .....                  | 5.65           | „      | Dunmanway, The Rectory ..     | 5.94           |
| VIII. | Nantwich, Dorfold Hall .....  | 3.55           | „      | Glanmire, Lota Lodge, No. 1   | 3.46           |
| „     | Chatburn, Middlewood .....    | 4.97           | „      | Mitchelstown Castle.....      | 3.61           |
| „     | Cartmel, Flookburgh .....     | 5.35           | „      | Darrynane Abbey.....          | 4.86           |
| IX.   | Langsett Moor, Up. Midhope    | 3.72           | „      | Clonmel, Bruce Villa .....    | 3.51           |
| „     | Scarborough, Scalby .....     | 2.24           | „      | Newmarket-on-Fergus.Fenloe    | ...            |
| „     | Ingleby Greenhow .....        | 3.69           | XXI.   | Laragh, Glendalough .....     | 7.64           |
| „     | Mickleton .....               | 3.80           | „      | Ballycumber, Moorrock Lodge   | 3.97           |
| X.    | Bellingham, High Green Manor  | 2.88           | „      | Balbriggan, Ardgillan .....   | 3.33           |
| „     | Ilderton, Lilburn Cottage ... | 2.95           | XXII.  | Woodlawn .....                | 3.65           |
| „     | Keswick, The Bank.....        | 6.56           | „      | Westport, St. Helens ...      | 3.66           |
| XI.   | Llanfdechfa Grange .....      | 6.10           | „      | Dugort, Slievemore Hotel ...  | 5.33           |
| „     | Treherbert, Tyn-y-waun .....  | 15.27          | „      | Mohill Rectory ..             | 4.60           |
| „     | Carmarthen, The Friary .....  | 6.03           | XXIII. | Enniskillen, Portora.....     | 4.31           |
| „     | Castle Malgwyn [Llechryd]...  | 5.87           | „      | Dartrey [Cootehill] .....     | 4.06           |
| „     | Crickhowell, Tal-y-maes.....  | 7.30           | „      | Warrenpoint, Manor House ..   | 4.60           |
| „     | New Radnor, Ednol .....       | 5.42           | „      | Banbridge, Milltown .....     | 2.52           |
| „     | Birmingham WW., Tyrmynydd     | 8.31           | „      | Belfast, Cave Hill Road ..... | 3.79           |
| „     | Lake Vyrnwy .....             | 5.61           | „      | Glenarm Castle.....           | 5.08           |
| „     | Llangyhanfal, Plâs Draw.....  | 3.64           | „      | Londonderry, Creggan Res...   | 3.61           |
| „     | Dolgelly, Bryntirion.....     | 6.87           | „      | Dunfanaghy, Horn Head ...     | 5.95           |
| „     | Bettws-y-Coed, Tyn-y-bryn...  | 6.36           | „      | Killybegs .....               | 5.41           |

## METEOROLOGICAL NOTES ON APRIL, 1913.

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.—Dull, showery weather generally, alternating with occasional fine sunny days. Temp. below the average in the first three weeks, but high during the last week. Sharp TS with heavy R and very vivid L in evening of 29th. Mean temp.  $48^{\circ}0$  or  $0^{\circ}1$  below the average. Duration of sunshine  $112\cdot3^*$  hours, and of R  $54\cdot4$  hours. Evaporation  $1\cdot25$  in. Shade max.  $68^{\circ}5$  on 29th; min.  $26^{\circ}0$  on 13th. F 2, f 8.

TENTERDEN.—Duration of sunshine  $135\cdot0^{\dagger}$  hours. Shade max.  $66^{\circ}5$  on 29th; min.  $27^{\circ}5$  on 13th. F 2, f 9.

TOTLAND BAY.—Duration of sunshine  $134\cdot5^*$  hours or  $46\cdot5$  hours below the average. Shade max.  $64^{\circ}9$  on 23rd; min.  $28^{\circ}9$  on 13th. F 1, f 4.

MILTON BRYAN.—Damp and dull, and a disappointing month for the agriculturalist. Heavy TS from 8 to 10 p.m. on 29th, with magnificent L display. Shade max.  $69^{\circ}0$  on 23rd; min.  $25^{\circ}0$  on 13th. F 6.

IPSWICH, COPDOCK.—Wet and very dull. Heavy S storm on 11th. Mean temp.  $46^{\circ}8$ . Duration of sunshine  $138\cdot0^{\dagger}$  hours. Shade max.  $64^{\circ}9$  on 29th; min.  $29^{\circ}7$  on 12th. F 2, f 12.

POLAPIT TAMAR.—Rough, wet, cold and sunless. Shade max.  $65^{\circ}8$  on 23rd; min.  $30^{\circ}5$  on 20th. F 2, f 8.

NORTH CADBURY.—Cloudy, cool and windy April, with a marked absence of extreme temp. Shade max.  $74^{\circ}0$  on 23rd; min.  $32^{\circ}0$  on 13th. F 1, f 7.

MACCLESFIELD.—Violent TS from 9 to 11 p.m. on 29th, with very vivid L and loud T. Shade max.  $65^{\circ}0$  on 21st; min.  $30^{\circ}0$  on 8th and 13th.

SOUTHPORT.—Duration of sunshine  $117\cdot2^*$  hours, and the least in April in 22 years' record. Duration of R  $73\cdot2$  hours. Evaporation  $1\cdot46$  in. Mean temp.  $46^{\circ}4$  or  $0^{\circ}9$  above the average. Shade max.  $64^{\circ}0$  on 24th; min.  $31^{\circ}0$  on 13th. F 1, f 10.

HULL.—Cloudy and fairly mild to 10th; wintry, with S on 11th and 12th; afterwards brighter and milder. Duration of sunshine  $81\cdot5^*$  hours. Shade max.  $63^{\circ}0$  on 29th; min.  $28^{\circ}0$  on 13th. F 1, f 10.

HAVERFORDWEST.—Duration of sunshine  $130\cdot2^*$  hours. Shade max.  $54^{\circ}7$  on 19th; min.  $30^{\circ}4$  on 12th.

BETTWS-Y-COED.—Shade max.  $64^{\circ}0$  on 23rd; min.  $30^{\circ}0$  on 8th and 13th. F 2, f 3.

CARGEN.—Wettest and dullest April since observations commenced 54 years ago. S fell for 7 hours on 11th. Shade max.  $62^{\circ}0$  on 23rd; min.  $28^{\circ}0$  on 2nd. F 2.

MARCHMONT.—Duration of sunshine  $122\cdot7$  hours. S fell to a depth of 4 inches on 11th. Shade max.  $62^{\circ}0$  on 24th; min.  $28^{\circ}0$  on 13th. F 5, f 13.

ARDNADAM.—Shade max.  $63^{\circ}8$  on 8th; min.  $29^{\circ}0$  on 1st. F 4, f 15.

LYNTURK.—S storm began in forenoon of 11th, continuing until night; depth 2 to 3 inches. Shade max.  $65^{\circ}5$  on 24th; min.  $17^{\circ}0$  on 12th. F 16.

FORT AUGUSTUS.—Shade max.  $60^{\circ}2$  on 24th; min.  $25^{\circ}0$  on 2nd. F 5.

LOCH STACK.—Duration of sunshine  $138\cdot8^*$  hours.

DUNMANWAY.—From 2nd to 14th fine and bright, with strong E. and N. winds; from 15th to end, unsettled weather; fine, bright days alternating with wet, cold days.

CLONMEL.—Heavy R on 25th, which changed to S, and from 1 to 3 p.m.  $2\frac{1}{2}$  inches of S fell. Temp.  $33^{\circ}$  at 3 p.m.

DUBLIN.—First 10 days mostly dry with prevalent N.E. winds; the rest of the month, excepting 21st to 23rd, was unsettled and showery with frequent high winds from S. and W. Mean temp.  $47^{\circ}6$ , and exactly the average. Shade max.  $58^{\circ}2$  on 30th; min.  $35^{\circ}7$  on 26th. F 0, f 0.

WARRENPOINT.—Cold and wet, with high winds and a good deal of fog and mist.

\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, November, 1912.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |        |          |        | Average. |      |               |           | Absolute.       |                   | Total Rain |       | Aver.<br>Cloud. |     |
|------------------------------------------------------------------|-----------|--------|----------|--------|----------|------|---------------|-----------|-----------------|-------------------|------------|-------|-----------------|-----|
|                                                                  | 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                                            | 56°3      | 9      | 27°0     | 3      | 48°6     | 38°7 | 39°9          | 0-100     | 86              | 76°7              | 23°5       | 1·59  | 16              | 8·3 |
| Malta ... ..                                                     | 72°5      | 16     | 51°0     | 24     | 64°0     | 56°3 | 50°6          | 74        | 136°3           | ..                | °65        | 17    | 4·9             |     |
| Lagos ... ..                                                     | 98°0      | 19     | 72°0     | 3      | 88°7     | 75°1 | 73°5          | 73        | 155°0           | 69°0              | 1°15       | 4     | 5·4             |     |
| Cape Town ... ..                                                 | 83°8      | 6      | 43°9     | 1      | 71°5     | 55°1 | 52°5          | 68        | ...             | ...               | 1°44       | 8     | 4·8             |     |
| Johannesburg ... ..                                              | 88°0      | 13, 21 | 44°1     | 17     | 81°8     | 57°2 | 42°1          | 44        | 155°0           | 43°2              | 1°51       | 9     | 3·4             |     |
| Mauritius ... ..                                                 | 83°5      | 22     | 60°9     | 7      | 81°4     | 66°8 | 63°4          | 71        | 154°0           | 54°3              | 1°05       | 15    | ...             |     |
| Bloemfontein ... ..                                              | 96°0      | 12     | 42°7     | 25     | 85°8     | 58°9 | 41°8          | 33        | ...             | ...               | °30        | 1     | 4·4             |     |
| Calcutta ... ..                                                  | 87°1      | 10     | 56°7     | 29     | 81°7     | 64°1 | 62°6          | 72        | ...             | 50°5              | 3°34       | 2     | 2·3             |     |
| Bombay ... ..                                                    | 92°4      | 17     | 68°4     | 25     | 86°9     | 74°0 | 68°5          | 69        | 137°2           | 62°4              | 3°62       | 2     | 2·0             |     |
| Madras ... ..                                                    | 92°2      | 1      | 67°6     | 10     | 85°3     | 72°3 | 72°1          | 85        | 140°2           | 70°0              | 21°81      | 18    | 4·9             |     |
| Kodaikanal ... ..                                                | 70°3      | 13     | 43°9     | 7      | 61°0     | 49°1 | 50°8          | 89        | 139°9           | 30°0              | 11°23      | 16    | 6·8             |     |
| Colombo, Ceylon ... ..                                           | 89°4      | 6      | 72°4     | 7      | 86°3     | 74°3 | 72°2          | 77        | 151°0           | 64°5              | 12°70      | 16    | 5·4             |     |
| Hongkong ... ..                                                  | 84°4      | 4      | 56°1     | 23     | 74°7     | 61°9 | 57°8          | 65        | 133°5           | ...               | °29        | 2     | 5·2             |     |
| Sydney ... ..                                                    | 99°1      | 15     | 54°0     | 7      | 75°9     | 60°6 | 55°0          | 61        | 153°4           | 43°7              | 2°56       | 19    | 5·7             |     |
| Melbourne ... ..                                                 | 99°6      | 14     | 39°3     | 9      | 69°6     | 52°3 | 47°9          | 61        | 152°9           | 34°3              | 2°37       | 13    | 6·7             |     |
| Adelaide ... ..                                                  | 95°0      | 21     | 44°3     | 25     | 73°7     | 55°0 | 48°7          | 55        | 153°7           | 37°8              | 2°01       | 11    | 6°0             |     |
| Perth ... ..                                                     | 93°1      | 25     | 44°7     | 14     | 75°8     | 56°0 | 51°2          | 56        | 158°9           | 40°0              | °56        | 6     | 3°0             |     |
| Coolgardie ... ..                                                | 102°0     | 26     | 41°6     | 15     | 83°1     | 54°1 | 44°8          | 37        | 171°0           | 37°2              | °10        | 4     | 3°1             |     |
| Hobart, Tasmania ... ..                                          | 76°5      | 14     | 42°0     | 1, 3   | 63°9     | 48°4 | 44°8          | 63        | 149°0           | 36°3              | 2°02       | 16    | 6·7             |     |
| Wellington ... ..                                                | 66°2      | 26     | 43°0     | 10, 80 | 60°9     | 50°7 | 48°2          | 76        | 141°2           | 35°2              | 5°87       | 20    | 7·7             |     |
| Auckland ... ..                                                  | 69°0      | 4*     | 45°0     | 20     | 63°9     | 52°2 | 51°6          | 79        | 135°0           | 41°0              | 1°97       | 17    | 7·2             |     |
| Jamaica, Kingston ... ..                                         | 90°5      | 4      | 69°8     | 30     | 85°9     | 72°6 | 71°8          | 86        | ...             | ...               | 10°68      | 14    | 5·8             |     |
| Grenada ... ..                                                   | 90°0      | 2      | 72°0     | 12     | 84°9     | 74°9 | ...           | 79        | 140°0           | ...               | 6°11       | 21    | 3·5             |     |
| Toronto ... ..                                                   | 59°2      | 5      | 22°8     | 28     | 46°8     | 34°1 | ...           | 82        | 102°7           | 16°3              | 2°46       | 11    | 6°3             |     |
| Fredericton ... ..                                               | 64°2      | 7      | 11°5     | 17     | 40°8     | 26°1 | 29°9          | 86        | ...             | ...               | 4°60       | 9     | 6°4             |     |
| St. John, N.B. ... ..                                            | 57°5      | 8      | 21°7     | 29     | 42°9     | 32°1 | 32°0          | 81        | ...             | ...               | 3°93       | 15    | 6°1             |     |
| Edmonton, Alberta ... ..                                         | 53°0      | 17     | 16°9     | 30     | 37°3     | 22°2 | ...           | 79        | 99°6            | 7°8               | °31        | 5     | 4°9             |     |
| Victoria, B.C. ... ..                                            | 55°4      | 16     | 30°3     | 28     | 49°5     | 41°1 | 42°0          | 88        | ...             | ...               | 5°04       | 22    | 7·7             |     |

\* 17 and 26.

MALTA.—Mean temp. of air 59°·6. Average daily sunshine 5·6 hours.

Johannesburg.—Bright sunshine 291·5 hours.

Mauritius.—Mean temp. of air 1°·4 and R ·68 in. below averages. Mean hourly velocity of wind 10·8 miles or 1·1 miles above average.

Bloemfontein.—Very dry, no grass for cattle.

KODAIKANAL.—Bright sunshine 113 hours.

COLOMBO.—Mean temp. of air 80°·3 or 0°·6 above, of dew point 0°·1 below, and R ·87 in. above, averages. Mean velocity of wind 3·9 miles per hour. TSS on 9 days.

HONGKONG.—Mean temp. of air 69°·3. Mean hourly velocity of wind 12·7 miles. Bright sunshine 184·7 hours.

Sydney.—R ·55 in. below average.

Adelaide.—Mean temp. of air 2°·7 below, and R ·88 in. above, averages.

Hobart.—Mean temp. of air 1°·2 below, and R ·50 in. below, averages.

Wellington.—Mean temp. of air 2°·6 below, and R 2·42 in. above, averages. Bright sunshine 170·9 hours. H on 2 days.

JAMAICA, KINGSTON.—Very heavy rains due to storms and hurricane from the 10th to the end of the month.

# Symons's Meteorological Magazine.

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## THE AUSTRALIAN ANTARCTIC EXPEDITION.

THE arrival in this country of Captain J. K. Davis, Commander of the Australian Antarctic Exploration ship "Aurora," has called renewed attention to the magnificent results of the Expedition under Dr. Mawson, which has been carrying on systematic observations at two points of the Antarctic Continent, 1,500 miles apart, at neither of which had a landing ever previously been made. Dr. Mawson and a large party spent the winter of 1912 at Adelie Land, which was discovered by the French and American Expeditions in 1840, and had never been seen since. He made extensive journeys into the interior, and arrived at his base from the last of these, in which his two companions had perished, after a solitary journey of more than twenty days. He was a few hours too late to return to Australia by the ship, which, after waiting to the last moment, had to leave on its 1,500 mile journey to pick up the second portion of the expedition. This party, under Mr. Wild, had wintered near Wilkes' Termination Land. Probably no polar explorer has ever encountered worse weather, or escaped more dangers, than Captain Davis in rescuing this party, which had carried on excellent work. Before leaving Dr. Mawson's base, and in his absence, Captain Davis had landed a relief party with ample stores; and it is the most remarkable feature of the expedition that Dr. Mawson has since been able to keep up wireless communication with Australia through a station which was specially erected on Macquarie Island. We believe that funds are now being raised to enable next year's expedition for the relief of Dr. Mawson to be extended into an additional scientific campaign. Australian enterprise has never previously, we believe, been extended to scientific exploration beyond the limits of the Commonwealth, and it must be gratifying to the small body of Australian enthusiasts, and indeed to the whole Australian people to know that scientific men at home recognise that better work has never been done, nor higher courage shown, by any British expedition. The generous help which the Australian Government gave to the fund for a memorial to Captain Scott and his companions, who fell in the way, lays a moral duty on this country to contribute at least an equal amount to the renewed efforts of the Australian Expedition, and to secure to it, at least, ". . . the glory of going on and still to be."

## SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

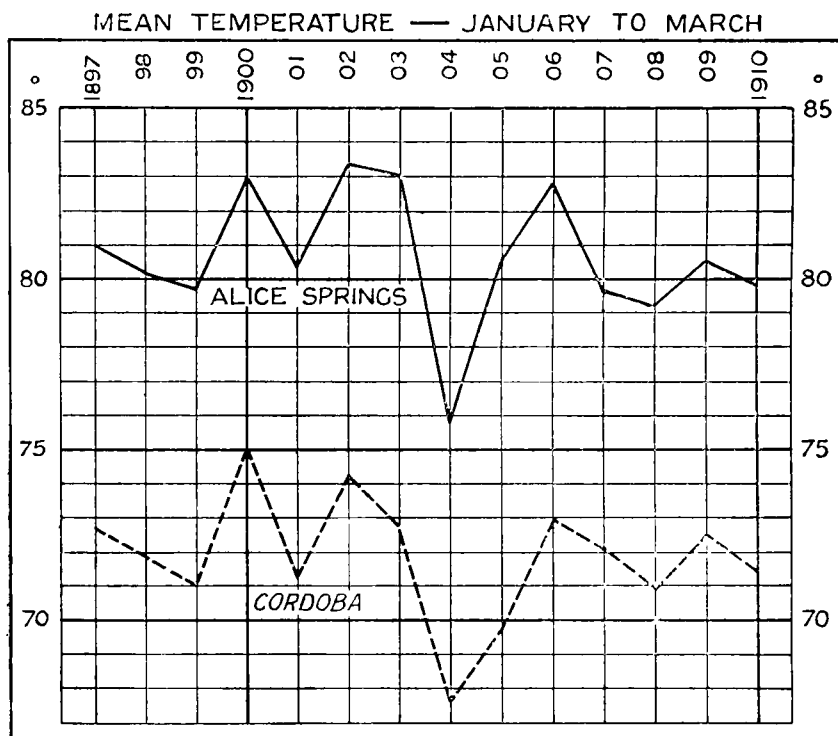
By R. C. MOSSMAN, F.R.S.E.

(of the Argentine Meteorological Office).

(Third Article.)

## AUSTRALIAN AND SOUTH AMERICAN CORRELATIONS.

DURING the three months January to March a remarkable parallelism is shown since 1897 in the curves of mean temperature at Alice Springs in the heart of Australia lat.  $23^{\circ} 38' S.$ , long.  $133^{\circ} 37' E.$ , height 1926 feet, and at Cordoba, Argentine Republic, lat.  $31^{\circ} 25' S.$ ,



long.  $64^{\circ} 12' W.$ , height 1437 feet, both stations being located in a strictly continental situation.\*

The following table gives the mean temperatures, the departure of these from the normal, and the year-to-year change for the period 1897-1910:—

Looking at the columns showing the departure from the normal it will be seen that the sign is the same in 11 of the 14 years discussed

\* I am indebted to Mr. W. G. Davis, Director of the Argentine Meteorological Office for the Cordoba data, and to Mr. H. A. Hunt, Commonwealth Meteorologist for the Alice Springs values.

| YEAR.      | Mean Temperature.* |          | Departure from Normal. |          | Year to Year Change. |          |
|------------|--------------------|----------|------------------------|----------|----------------------|----------|
|            | Alice Springs.     | Cordoba. | Alice Springs.         | Cordoba. | Alice Springs.       | Cordoba. |
| 1897 ..... | 81·0               | 72·7     | +0·4                   | +0·9     | ...                  | ...      |
| 1898 ..... | 80·2               | 71·9     | -0·4                   | +0·1     | -0·8                 | -0·8     |
| 1899 ..... | 79·7               | 71·1     | -0·9                   | -0·7     | -0·5                 | -0·8     |
| 1900 ..... | 83·0               | 75·0     | +2·4                   | +3·2     | +3·3                 | +3·9     |
| 1901 ..... | 80·3               | 71·2     | -0·3                   | -0·6     | -2·7                 | -3·8     |
| 1902 ..... | 83·3               | 74·2     | +2·7                   | +2·4     | +3·0                 | +3·0     |
| 1903 ..... | 83·0               | 72·7     | +2·4                   | +0·9     | -0·3                 | -1·5     |
| 1904 ..... | 75·7               | 67·6     | -4·9                   | -5·2     | -7·3                 | -5·1     |
| 1905 ..... | 80·5               | 69·7     | -0·1                   | -2·1     | +4·8                 | +2·1     |
| 1906 ..... | 82·8               | 72·9     | +2·2                   | +1·1     | +2·3                 | +3·2     |
| 1907 ..... | 79·7               | 72·1     | -0·9                   | +0·3     | -3·1                 | -0·8     |
| 1908 ..... | 79·2               | 70·9     | -1·4                   | -0·9     | -0·5                 | -1·2     |
| 1909 ..... | 80·5               | 72·5     | -0·1                   | +0·7     | +1·3                 | +1·6     |
| 1910 ..... | 79·8               | 71·4     | -0·8                   | -0·4     | -0·7                 | -1·1     |
| Mean.....  | 80·6               | 71·8     | ...                    | ...      | +2·4                 | +2·2     |

and the reverse in the other three. Further it will be observed that the very cold weather noted at Alice Springs in the year 1904 was also equally remarkable at Cordoba, while the years 1900, 1902, 1903, and 1906 notable for hot weather in the January to March period, were characterised by temperature excesses of much the same magnitude at both places, except in the year 1903 when the warmth was more pronounced in central Australia than in central Argentina. Previous to 1897 the records for the two places covering the 18 years 1879-1896 show no definite agreement.

During the same three months of the year an opposition is shown in the mean temperature curves at Perth, West Australia, on the one hand and at Valparaiso and Santiago (Chile) on the other. At Perth and Valparaiso conditions are strictly insular, but at Santiago the conditions are those that pertain to an inland, but not a continental, situation as is the case at Alice Springs and Cordoba.

The following table shows the mean temperature of the January to March period for the three stations.

The mean values at Perth are the average of the daily maxima and minima, at Santiago the means are from hourly values and at Valparaiso from tri-daily readings brought to the mean of the 24 hours by corrections supplied by hourly term-day observations.†

For the first two stations the data cover the 26 years 1886-1911, but for Valparaiso only the nine years 1901-1909 are available. The opposition, as in the case of the Cordoba-Alice Springs agreement, is not well marked previous to 1897, so that the data discussed refer to the same term of 14 years (1897-1910) as used for Alice Springs and Cordoba.

\* The mean at Alice Springs is the average of the maxima and minima. At Cordoba the data refer to hourly values.

† I am indebted to Mr. H. A. Hunt for the Perth data. The Santiago values are taken from the *Anuarios* of the Santiago Astronomical Observatory, and for Valparaiso from the annual publications of the Navy (*Servicio Meteorologico*).



The mean temperatures are as follows:—

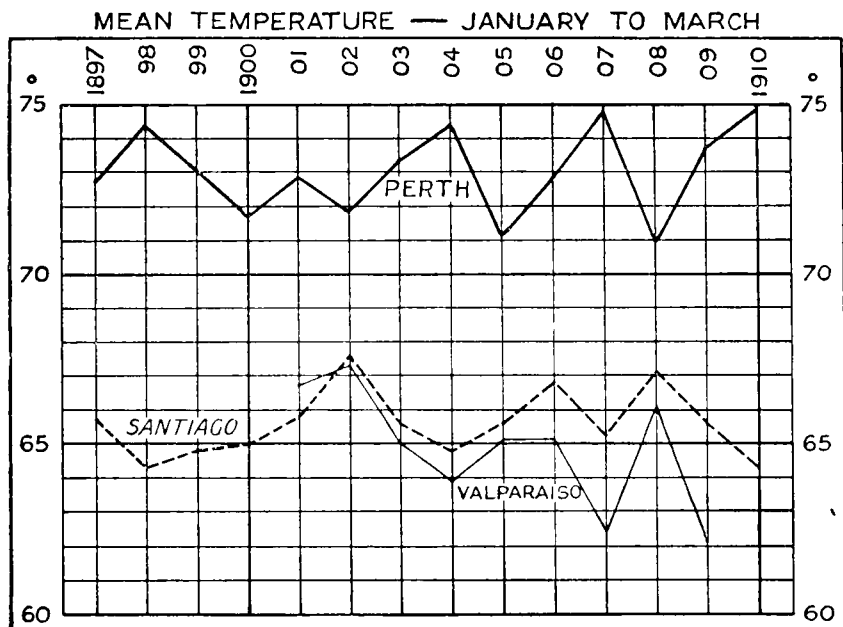
| MEAN TEMPERATURES, JANUARY TO MARCH. |       |       |       |       |       |       |       |      |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|------|
|                                      | 1897. | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. |      |
| Perth .....                          | 72·7  | 74·4  | 73·0  | 71·7  | 72·8  | 71·8  | 73·3  |      |
| Santiago .....                       | 65·7  | 64·3  | 64·8  | 65·0  | 65·8  | 67·6  | 65·6  |      |
| Valparaiso .....                     | —     | —     | —     | —     | 66·7  | 67·3  | 65·0  |      |
|                                      | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1910. | Mean |
| Perth .....                          | 74·4  | 71·1  | 72·8  | 74·8  | 70·9  | 73·7  | 74·8  | 73·0 |
| Santiago .....                       | 64·8  | 65·6  | 66·8  | 65·2  | 67·1  | 65·6  | 64·3  | 64·9 |
| Valparaiso .....                     | 63·9  | 65·1  | 65·1  | 62·4  | 66·6  | 62·1  | —     | —    |

|                  | Lat. S. | Long.       | Height ft. |
|------------------|---------|-------------|------------|
| Perth .....      | 31° 57' | 115° 52' E. | 49         |
| Santiago .....   | 33° 27' | 70° 42' W.  | 1703       |
| Valparaiso ..... | 33° 1'  | 71° 38' W.  | 135        |

The following table shows the departure from the normal during the nine years 1901-1909 for which we have data from all three stations:—

|               | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Perth .....   | 0°0   | -1°0  | +0°5  | +1°6  | -1°7  | 0°0   | +2°0  | -1°9  | +0°9  |
| Santiago..... | -0·2  | +1·6  | -0·4  | -1·2  | -0·4  | +0·8  | -0·8  | +1·1  | -0·4  |
| Valparaiso..  | +1·8  | +2·4  | +0·1  | -1·0  | +0·2  | +0·2  | -2·5  | +1·7  | -2·8  |



Referring the Perth and Santiago values to the mean of the 14 years 1897-1910 we find 11 cases in which the signs are the reverse of each other and 3 in which they agree. For the 11 years 1886-1896 in only 4 years is there an opposition, while in 7 years there

is agreement, so that, as in the case of the Cordoba-Alice Springs observations, the correlation begins with the year 1897.

It is of interest to note that during the three months under review there is an opposition between the mean temperature at Santiago and the thickness of the ice at Duluth, Lake Superior, U.S.A.

The following are the values, those referring to Duluth being taken from the "Monthly Charts of the Great Lakes," issued by the U.S. Weather Bureau, and those for Santiago de Chile from the source already referred to:—

|                  | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1910. | 1911. | Mean.     |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|
| Ice at Duluth... | 21.1  | 22.7  | 18.8  | 25.3  | 33.0  | 21.4  | 19.2  | 24.9  | 17.8  | 19.7  | 27.6  | 26.5  | 23.2 ins. |
| Santiago Temp..  | 65.0  | 65.8  | 67.6  | 65.6  | 64.8  | 65.6  | 66.8  | 65.2  | 67.1  | 65.6  | 64.3  | 64.0  | 65.6 deg. |

Transforming the above values so as to show the departure from the normal of the 12 years under review we have the following:—

|                   | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. | 1909. | 1910. | 1911. |      |
|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| Ice at Duluth ... | —2.1  | —0.5  | —4.4  | +2.1  | +9.8  | —1.8  | —4.0  | +1.7  | —5.4  | —3.5  | +4.4  | +3.2  | ins. |
| Santiago Temp.    | —0.6  | +0.2  | +2.0  | 0.0   | —0.8  | 0.0   | +1.2  | —0.4  | +1.5  | 0.0   | —1.3  | —1.6  | deg. |

These results are of interest inasmuch as they indicate an interrelation between the action centres governing the conditions during the three months under consideration in Australia, South America, and the United States.

*(To be continued.)*

## ROYAL METEOROLOGICAL SOCIETY.

AN ordinary afternoon meeting of the Society was held at 70, Victoria Street, S.W., Mr. C. J. P. Cave, President, in the chair.

Mr. E. Gold described the methods adopted and the results obtained in his paper on the "Determination of Radiation of the Air from Meteorological Observations." The basis of the determination was a series of observations made at Potsdam. The temperature for hourly intervals, both at the summit and foot of a tower 40 metres high, was studied with regard to the rate of fall on a number of clear nights, and from the results radiation values were deduced. Attempts to reconcile these values with those obtained by laboratory experiments were disappointing; and the author suggested that convection must play a large part as a disturbing influence.

Dr. C. Chree considered that the tower at Potsdam was not satisfactorily situated for the experiment.

Mr. C. Salter drew attention to the fact of the difference in the amount of dust at a height of 2 metres and of 40 metres, and suggested that, given equal humidity, the radiation at the top and the bottom of the tower might well be different from that cause.

Mr. S. C. Russell read a paper on the "Results of Monthly and Hourly Cloud Form Frequencies at Epsom, 1903–1910." A series of personal observations by day and night was systematically studied,

and formed a unique record of great interest. Curves showing the monthly and hourly frequency for each type exhibited pronounced maxima and minima. Amongst these may be noticed the marked prevalence of the upper clouds for the summer months, with minima during the winter. Except in the case of cumulus and cumulonimbus, morning and evening maxima are usual. These two varieties have each one maximum, the former at noon, the latter at 3 p.m.

Mr. R. Inwards proposed automatic photographic observations of the sky ; by a simple arrangement a camera could be mechanically directed to the windward, and exposures made as desired.

Mr. Gold said that the record provided the data necessary to apply corrections to 9 a.m. observations in order to arrive at the normal value for the day. The double diurnal maximum might be connected with the similar phenomenon in barometric pressure.

Mr. W. W. Bryant suggested that the midday maximum of cumulus might on account of the cumulus obscuring the upper clouds be responsible for the minimum in the latter at noon.

Mr. R. Strachan and Mr. Marriott also took part in the discussion.

The following new Fellows were elected :—Mr. A. E. Felton, J.P., Capt. L. B. Bennett-Gillman and Lieut. G. Rawson.

Dr. V. F. K. Bjerknes, Professor of Geophysics at the University, Leipzig, and Dr. Hugo Hergesell, President of the International Commission for Scientific Aeronautics, Strassburg, were elected honorary members of the Society.

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The Biennial Dinner of the Royal Meteorological Society was held at the Trocadero Restaurant on Tuesday evening, May 20th.

The following Fellows and guests were present :—

Mr. F. Campbell Bayard, Mr. J. Bernard, *President, Scottish Meteorological Society*, Capt. H. A. Blake, *Deputy Master of Trinity House*, Mr. A. H. Brown, Mr. W. W. Bryant, Commander W. F. Caborne, C.B., Mr. C. J. P. Cave, *President*, in the Chair, Dr. C. Chree, F.R.S., Mr. Cyril Cobb, *Chairman, London County Council*, Mr. R. Cooke, Mr. F. Corry, Mr. Elliott Cooper, *President, Institution of Civil Engineers*, Rear-Admiral H. E. P. Cust, C.B., *Hydrographer of the Navy*, Dr. H. N. Dickson, Mr. F. Druce, Dr. F. W. Dyson, F.R.S., *Astronomer Royal*, Mr. W. Ellis, F.R.S., Mr. H. N. Farington, Dr. R. T. Glazebrook, F.R.S., Mr. E. Gold, Mr. W. Vaux Graham, Major E. H. Hills, C.M.G., F.R.S., *President, Royal Astronomical Society*, Mr. R. H. Hooker, Mr. A. P. Jenkin, Dr. A. J. Jex-Blake, Sir Philip Burne Jones, Prof. F. Keeble, F.R.S., Mr. Baldwin Latham, C.E., Mr. G. B. Latham, C.E., Mr. R. G. K. Lempfert, Mr. A. Mallock, Mr. W. Marriott, Mr. T. McRow, Lt.-Col. H. Mellish, Mr. T. H. Middleton, Mr. R. L. Mond, Mr. G. R. Pember, Col. H. E. Rawson, C.B., Dr. E. J. Russell, Hon. Rollo Russell, Mr. C. Salter, Mr. W. Sedgwick, Dr. W. N. Shaw, F.R.S., *Director, Meteorological Office*, Mr. A. J. Sidgwick, Capt. A. Simpson, Sir Alexander Stenning, Hon. E. G. Strutt, *President, Surveyors' Institution*, Alderman H.



# THAMES VALLEY RAINFALL — MAY, 1913.



ALTITUDE  
SCALE

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

SCALE OF MILES

0 5 10 15 20

Lyon Thomson, *Mayor of the City of Westminster*, Mr. W. Tattersall, Rt. Hon. Earl Waldegrave, Mr. F. J. W. Whipple.

The President proposed the loyal toasts and was followed by Mr. Elliott Cooper, *President of the Institution of Civil Engineers*, who, in proposing the toast of the Royal Meteorological Society, spoke with enthusiasm of the utility of the work of meteorologists, more particularly rainfall observers, to engineers. In the course of his reply Mr. Cave announced the intention of the Society to prepare, in the not far distant future, a British meteorological atlas.

Major E. H. Hills and Hon. E. G. Strutt, replied to the toast of Kindred Institutions proposed by Mr. F. Druce; and Lord Waldegrave and Capt. H. A. Blake, replied to that of the Visitors proposed by Commander W. F. Caborne.

Dr. W. N. Shaw proposed "The President," and Mr. Cave replied.  
C.S.

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### THE WEATHER OF MAY.

THE month opened in unsettled conditions, local thunderstorms being felt in almost all districts and rain and hail being of frequent occurrence. On the 8th a depression moved northward across Ireland and the wind increased to gale force on the north coast of Ireland and the north-east of Scotland. Rain fell generally, many stations in the north-east of Great Britain recording more than 1.00 inch and at Crathes the fall was 1.63 inch. Little change took place in the pressure distribution on the 9th and heavy rain continued to fall over the east of Scotland. At Crathes a further fall of 2.76 inches was measured, the rain having fallen continuously for 36 hours. The greater part of the week following was fair and dry, and temperature, which had been low, rose in all districts, the greatest rise taking place in the south-west of England. From the 17th to the 19th the wind was north-westerly and blew strongly in the north-west and north of the British Isles, and with gale force at Malin Head and over western Ireland. Cloudy or overcast conditions continued over the country generally and a thick sea fog set in on the 23rd on the coasts of the Irish Sea and the English Channel. A large anti-cyclonic system spread over the country from the Bay of Biscay on the 24th, and fine, bright weather set in with a rise in temperature, which, on the 25th, reached 76° at Leamington Spa, 77° at Margate, Nottingham and Bath, and 82° at Camden Square. This unusual warmth continued over the southern part of the kingdom for nearly a week, but in Scotland and Ireland the shade maxima were usually below 60° and in many places failed to reach 55°. A severe thunderstorm occurred over Shropshire on the afternoon of the 26th.

The rainfall of the month was generally in excess of the average, the greatest excess being in Ireland. The general fall expressed as a percentage of the average over the great divisions of the kingdom was as follows: England and Wales, 112; Scotland, 129; Ireland, 154; British Isles, 128.



## HIGH MAY TEMPERATURES IN LONDON.

DURING the period of fine weather at the end of May, 1913, the maximum shade temperatures recorded at Camden Square exceeded  $80^{\circ}$  on each of the six consecutive days, May 25th to May 30th. Such a run of high temperatures had never previously been recorded in May. The nearest approach since Mr. Symons commenced the record in 1858 is to be found on three occasions when three consecutive days with temperatures over  $80^{\circ}$  were recorded in May. There were also 5 occasions with May temperatures exceeding  $80^{\circ}$  on two consecutive days, and 24 occasions when an isolated day in May had a maximum temperature above  $80^{\circ}$ . All the cases when such temperatures were recorded are set out in chronological order in the Table below. It will be observed that the highest May temperature was on May 19th, 1868, when it reached  $87^{\circ}\cdot6$ .

*Days in May with Temperature above  $80^{\circ}$ .*

| Year.    | Day. | Shade<br>max.      | Year.    | Day. | Shade<br>max.      | Year.    | Day. | Shade<br>max.      |
|----------|------|--------------------|----------|------|--------------------|----------|------|--------------------|
| 1859 ... | 31st | $80^{\circ}\cdot6$ | 1870 ... | 19th | $81^{\circ}\cdot0$ | 1905 ... | 29th | $83^{\circ}\cdot2$ |
| 1861 ... | 21st | $80^{\circ}\cdot8$ | „ ...    | 21st | $85^{\circ}\cdot1$ | 1907 ... | 12th | $82^{\circ}\cdot3$ |
| „ ...    | 23rd | $80^{\circ}\cdot5$ | „ ...    | 22nd | $80^{\circ}\cdot8$ | 1909 ... | 21st | $83^{\circ}\cdot2$ |
| 1862 ... | 6th  | $81^{\circ}\cdot1$ | 1875 ... | 15th | $82^{\circ}\cdot0$ | „ ...    | 22nd | $82^{\circ}\cdot7$ |
| 1864 ... | 15th | $80^{\circ}\cdot4$ | 1880 ... | 26th | $85^{\circ}\cdot0$ | 1910 ... | 22nd | $80^{\circ}\cdot0$ |
| „ ...    | 18th | $84^{\circ}\cdot5$ | 1881 ... | 31st | $80^{\circ}\cdot7$ | 1911 ... | 28th | $80^{\circ}\cdot3$ |
| „ ...    | 19th | $82^{\circ}\cdot1$ | 1884 ... | 24th | $81^{\circ}\cdot3$ | „ ...    | 29th | $81^{\circ}\cdot4$ |
| „ ...    | 20th | $83^{\circ}\cdot0$ | 1889 ... | 23rd | $80^{\circ}\cdot8$ | „ ...    | 31st | $81^{\circ}\cdot7$ |
| 1865 ... | 21st | $81^{\circ}\cdot0$ | „ ...    | 24th | $81^{\circ}\cdot2$ | 1912 ... | 11th | $81^{\circ}\cdot2$ |
| 1867 ... | 6th  | $84^{\circ}\cdot0$ | 1891 ... | 13th | $80^{\circ}\cdot2$ | 1913 ... | 25th | $82^{\circ}\cdot4$ |
| „ ...    | 7th  | $83^{\circ}\cdot2$ | 1892 ... | 28th | $82^{\circ}\cdot2$ | „ ...    | 26th | $84^{\circ}\cdot4$ |
| „ ...    | 8th  | $82^{\circ}\cdot0$ | „ ...    | 31st | $84^{\circ}\cdot7$ | „ ...    | 27th | $83^{\circ}\cdot8$ |
| „ ...    | 10th | $80^{\circ}\cdot1$ | 1895 ... | 12th | $80^{\circ}\cdot4$ | „ ...    | 28th | $81^{\circ}\cdot9$ |
| 1868 ... | 3rd  | $82^{\circ}\cdot2$ | „ ...    | 30th | $86^{\circ}\cdot2$ | „ ...    | 29th | $82^{\circ}\cdot6$ |
| „ ...    | 19th | $87^{\circ}\cdot6$ | 1903 ... | 30th | $80^{\circ}\cdot9$ | „ ...    | 30th | $80^{\circ}\cdot3$ |
|          |      |                    | „ ...    | 31st | $80^{\circ}\cdot5$ |          |      |                    |

The foregoing comparison is made possible only because the observations were all made in one locality, and by instruments exposed in exactly the same manner throughout the whole 56 years over which the record extended. It is impossible to compare extreme phenomena of any kind occurring in a given year with past observations at different stations, or taken by instruments exposed in different ways. This fact is frequently lost sight of, and records appear in the newspapers, and sometimes even in scientific publications, comparing weather conditions for one part of London with records taken in other parts of London without specifying the different conditions in which the observations were made. We ought to explain that the Camden Square record is not itself absolutely free from the possibility of criticism on this score, as the place of observation was moved about 200 yards at the end of 1865; but the exposure was similar, at the same height above the ground, and on the same pattern of stand, so that there appears to be little reason

to suspect differences in the readings. As to the difference between temperature in widely separated localities within London, and different methods of exposure of the thermometers to the air, we quote below the readings for the six days in question at all the stations the results of which are published in the Daily Weather Report of the Meteorological Office, supplemented by a second set of observations at Camden Square taken in the Stevenson screen, and two additional sets at the Royal Observatory, Greenwich, taken in different forms of thermometer screens, and communicated to us by the courtesy of the Astronomer Royal.

*Shade Maximum Temperatures, May 25th—30th, 1913.*

|                                 | 25th. | 26th. | 27th. | 28th. | 29th. | 30th. |
|---------------------------------|-------|-------|-------|-------|-------|-------|
| Kew Observatory .....           | 79°   | 81°   | 77°   | 76°   | 79°   | 76°   |
| Greenwich, Royal Observatory    | 81    | 84    | 84    | 81    | 81    | 80    |
| Westminster, St. James's Park   | 78    | 80    | 80    | 77    | 77    | 77    |
| South Kensington, Museum Grnds. | 80    | 81    | 79    | 78    | 79    | 78    |
| St. Pancras, Camden Square...   | 82    | 84    | 84    | 82    | 83    | 80    |
| Hampstead Observatory.....      | 77    | 78    | 78    | 76    | 76    | 75    |
| *Greenwich, Royal Obs.,         |       |       |       |       |       |       |
| <i>Glaisher screen</i>          | 81·2  | 83·5  | 84·1  | 80·8  | 81·4  | 79·5  |
| ,, <i>Stevenson screen</i>      | 79·8  | 81·0  | 81·0  | 78·1  | 78·5  | 77·3  |
| ,, <i>New stand</i>             | 80·2  | 82·0  | 82·7  | 79·8  | 79·7  | 77·8  |
| *Camden Square,                 |       |       |       |       |       |       |
| <i>Glaisher screen</i>          | 82·4  | 84·4  | 83·8  | 81·9  | 82·6  | 80·3  |
| ,, <i>Stevenson screen</i>      | 81·9  | 82·0  | 81·5  | 80·5  | 79·0  | †     |

The Glaisher stand is open, and in the Camden Square pattern unprotected at the sides, but always kept turned in such a position that the sun is shining on the back, which is made of a double thickness of wood separated by a wide air space. This stand is periodically turned with the back to the sun, so that in no condition can the sunlight fall upon the bulbs. The Stevenson screen, as is well known, is a box with louvre boarded sides, through which the wind can blow, and a double roof with air circulation between. It will be observed that the readings on the Glaisher stand are the highest in every case, while those on the Stevenson screen are lower, though not to the same extent on every occasion. Comparing the Stevenson screen readings, one sees how much the maximum temperature varies from place to place, and how essential it is in speaking of the temperature in London to specify the point of observation. It may

\* These observations are quoted to the nearest degree in the *Daily Weather Report*.

† The Stevenson screen reading at Camden Square was unfortunately not available on this date, as advantage was being taken of the fine weather to paint the screen.



be mentioned that the differences in the thermometer readings quoted are much in excess of any differences which could be ascribed to personal equation or to instrumental error. It is possible that they are due to small differences in the construction of the screens; but in the case of maximum temperatures, to which alone we refer, it seems more likely that gusts of air from heated surfaces in the neighbourhood which may hit or miss the screen are responsible for the extreme readings; and the public should bear in mind that extreme values, however interesting they may be, are those most subject to temporary or accidental variations, so that only differences of several degrees can be looked upon as indicating physical dissimilarities.

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### Correspondence.

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

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#### THE MAGNIFICENT WEATHER OF MAY 23rd—30th.

THERE is no feature in the seasonal climatology of England so unfailing, perhaps, as a spurt of fierce thunder-breeding heat some time during the month of May, and when it occurs towards the end of the month, as in the present year, and as is more usually the case, the full glory of midsummer is seen to an advantage unknown after the solstice when the birds are silenced and the countryside is comparatively flowerless.

The superb weather of the recent May commenced on the 23rd with brilliant sunshine and a cool atmosphere. By the evening of the 24th a burst of severe heat was evidently at hand, and on Sunday, 25th, the terrific heat of the sun and the dazzling intensity of the light were such as are rather infrequent in England. Early next morning the heat threatened to be greater still, but it had engendered a partial cloudiness of the sky, and the temperature in the shade was not appreciably different from that on the 25th, but remained around 80°, at about which level it stood every afternoon following, till the 30th.

On the evening of Tuesday, 27th, a mass of overpoweringly grand cumulus clouds developed, with destructive hail and thunderstorms locally, whilst a most sultry evening on the 29th, with gorgeous sunset hues, was followed during the short hours of darkness by thunderstorms which, though rather severe, were not, on the whole, so violent as those in the famous May of 1911. The experience of each successive year tends to strengthen my conviction that though bad thunderstorms may occur at any period of the summer, there is no short period of the year so prolific of storms of the most malignant and dangerous type over the country generally as the week or ten days which mark the passing of May into June.

L. C. W. BONACINA.

*June 2nd, 1913, Hampstead, N. W.*

## THUNDERSTORM ON MAY 27th, 1913.

A THUNDERSTORM extending from 3.30 p.m. till 8.10 p.m. occurred here on May 27th. Succeeding a morning of intense heat, highly developed electrical cumulus gathered to the N.W. and N. towards 2.30 p.m. Throughout the day there had been an exceptionally strong upper current from the S.W., judged by the rapidity of the movement of the cirrus. At 3 p.m. a most impressive range of cumulus and cumulo-nimbus, peaks of mountainous bubbling clouds, occupied the whole of the N. horizon, with pendulous hanks of false cirrus, extending very slowly, in fan-shape formation towards the zenith. Thunder was first heard at 3.30 p.m. in the N.W., continuous thunder taking place at intervals of three to five minutes to 5 p.m., when the rate rose to one to two minute intervals, with some increase in intensity. The rate of travel along the northern horizon was exceptionally slow, and the extension of the cloud area beyond the zenith appeared to be wholly retarded, the South Downs being bathed in sunshine with a cloudless sky area from S.E. round to W. At 5.30 p.m. it was apparent that a storm of exceptional severity was raging along the whole of the northern skyline, no propagation of the cloud area beyond the zenith taking place. The first lightning was seen at 6 p.m., the time interval to thunder being eleven seconds. The storm passed the point of observation between 6.5 and 6.13 p.m., accompanied by vivid discharges of sheet and fork lightning and loud rattling thunder peals, the time intervals varying between one and three seconds. At 6.12 p.m. a blinding flash of fork lightning took place, being followed by thunder in just under one second, and at this time a large elm tree was struck by lightning, and the bark of the trunk ten feet from the ground was stripped up for a distance of over eight feet by a foot broad, the stroke penetrating almost to the core of the tree, which was otherwise undamaged. At 6.17 p.m. the time interval had risen to 18 seconds, the storm travelling very rapidly in an easterly direction. At 6.9 p.m. large but very scattered lumps of clear cubes of ice fell, being followed by very heavy rain to 6.13 p.m., the amount measured in the four minutes totalling .21 in. Less than a quarter of a mile distant no rain was recorded, the sky away to the southward being as at 5 p.m. entirely cloudless. Retardation in the rate of travel again set in, and the last thunder was not heard till 8.10 p.m., when the storm appeared to be lying due E., massive electrical cumulus still holding along the N. horizon. At 10 p.m. sheet lightning discharges were taking place to the N. and N.E. at the rate of five per minute. The barograph showed a gentle decrease in pressure between 9 a.m. and 3 p.m., when there was a sudden fall of .02 in., then a steady curve with sudden pressure increases of .03 in. at 6 and 8 p.m.

SPENCER C. RUSSELL, F.R.Met.Soc.

*Southwater, Sussex, May 29th, 1913.*

**THUNDERSTORM OF 30th MAY, 1913.**

LIGHTNING struck an elm tree in Carshalton Park about 30 ft. above the ground, then it divided, going down each side of the tree to the height of two horses standing underneath when the branches of lightning left the tree for the horses, killing each instantly. A house was also struck in Stanley Park Road and a considerable amount of damage was done. About 10 ft. of a chimney at the back was destroyed and fell through the roof, the remainder of the chimney being cut in half and the kitchen grate blown out.

*Wallington, June 1st, 1913.*

F. CAMPBELL-BAYARD.

**EXCEPTIONAL RAINFALL AT BISHOPS CASTLE,  
26th MAY, 1913.**

DURING a violent thunderstorm here on May 26th lasting one hour fifteen minutes, 1·25 in. of rain fell, of which ·95 in. fell in twenty minutes. It is probable that of this amount ·50 in. fell in five minutes, so heavy was the fall of rain. Hail of the size of marbles fell in large quantities. The peculiarity of the storm was that it first passed to westward in a northerly direction and then returned over here with increased violence, travelling from north to south.

*Bishops Castle, May 27th, 1913.*

E. GRIFFITHS.

**THE WETTEST FIRST QUARTER ON RECORD.**

A LETTER, entitled the above, appeared in your columns in August last, and if the word "Quarter" be changed into "Third of a Year," the heading holds good for this year. Up to the end of September, 1912 was the wettest year in 18 years' observations, but the year, as a whole, was the the third wettest. This year the 1912 record was overtaken in April with a fall of 5·20 in., against ·20 in. in 1912. In the five days, April 25th–29th, the fall was 2·97 in. Over half the year's average fall has descended in the first four months.

| 1912.         | Rainfall.   | Departure<br>from 7 years'<br>average. | 1913.         | Rainfall.   | Departure<br>from 7 years'<br>average. |
|---------------|-------------|----------------------------------------|---------------|-------------|----------------------------------------|
| January ..... | 5·45        | +2·73                                  | January ..... | 5·55        | +2·83                                  |
| February..... | 2·85        | +·79                                   | February..... | 1·67        | —·39                                   |
| March .....   | 6·32        | +2·94                                  | March .....   | 5·83        | +2·45                                  |
| April .....   | 0·20        | —2·59                                  | April .....   | 5·20        | +2·41                                  |
|               | <hr/> 14·82 | <hr/> +3·87                            |               | <hr/> 18·25 | <hr/> +7·30                            |

This year, therefore, the first four months have broken the record (since 1895 inclusive) by no less than 3·43 in., and May is continuing this deplorable record, 2·27 in. having fallen in the first eleven days, which is ·16 in. more than the fall for the whole of May last year. Prayers for fair weather have been offered in the churches for several weeks.

R. P. DANSEY.

*Kentchurch Rectory, Hereford, May 12th, 1913.*

## RAIN DAYS IN 1913.

FOR the first five months of 1913 I have registered no less than 82 wet days. I have taken meteorological observations here for the past 27 years. The following is the greatest total number of wet days and the rainfall for the first five months:—

|                                                | Wet Days. | Rainfall.<br>in. |
|------------------------------------------------|-----------|------------------|
| January–May, 1889.....                         | 79 .....  | 8·36             |
| „ 1897.....                                    | 78 .....  | 14·85            |
| „ 1906.....                                    | 75 .....  | 15·26            |
| „ 1913.....                                    | 82 .....  | 13·90            |
| 27 years' average<br>(1st January—May 31st)... | 67 .....  | 9·62             |

JOHN DOVER.

*Aston House, Totland Bay, Isle of Wight, June 3rd, 1913.*

## A WHITE RAINBOW.

AN atmospheric effect, quite new to me, appeared here last evening, May 25th, and I write thinking its description may be of interest to your readers.

The day had been densely foggy, thick sea fog, with no wind. Towards evening a light air from the north drifted the fog towards the sea, the sun shone out brilliantly, and a complete bow of light, practically white but with traceable rainbow tints, appeared in the S.E. against the grey fog. A most beautiful and delicate effect.

The time was 5.30 p.m., and the appearance lasted perhaps half an hour. The upper sky was intensely blue at the time.

HERBERT E. BUTLER.

*The Orchard, Polperro, Cornwall, May 26th, 1913.*

## THE SCOTTISH WINTER.

I WAS interested by Mr. Bonacina's reflections on weather in the March number, but is not the greater instability of temperature in Scottish winter rather due to the circumstance that cyclonic centres more often pass to the *south* than in our southern counties? This gives east gales and snow while we get west gales and rain. The reason in the article referred to seems to be greater proximity to North Atlantic low pressure—not quite the same thing.

STANLEY SINGLE.

*Park View, Leopold Road, Wimbledon, April 8th.*

## REVIEWS.

*La Pluie en Chine durant une Période de onze années, 1900-10.* Par [Rainfall in China during a period of eleven years, by] LOUIS FROC, S.J. (Observatoire de Zi-ka-wei. Appendice au Bulletin Meteorologique de 1910). Chang-hai, 1912. Size  $12 \times 9\frac{1}{2}$ , pp. 62, plates.

THE Jesuits have always been distinguished among religious Orders for the assiduity with which they have cultivated astronomical and meteorological observation in the various parts of the world where they have established themselves, and the Observatory of Zi-ka-wei, China, is, we believe, far from least in importance among those under their direction. The present publication embodies fairly full statistics of the rainfall of about a hundred stations in China proper. At Zi-ka-wei, in lat.  $31^{\circ}$  N., the average rainfall for the eleven years is 45.7 inches, and at Hong Kong 80.1 inches, whilst at Tche-fou, in lat.  $37^{\circ}$  N., it is 23.1 inches, which is the lowest amount among the 34 stations with a complete record for the whole period. China is under the meteorological régime of the Pacific monsoon system of weather, and accordingly we find that the rainfall is heaviest during the hot period, May to September. Thus at Zi-ka-wei the July rainfall amounts to 7.4 inches, whilst the December fall is only 1.2 inches on the average of the eleven years. The 80 inches of rain at Hong Kong, in lat.  $22\frac{1}{2}^{\circ}$  N., fall on 151 days in the year, as compared with the 25 inches of London, in lat.  $51\frac{1}{2}^{\circ}$  N., spread over 170 days. One of the stations whose records are discussed failed, apparently, to furnish a record of the snowfall of the winter months, either as such or the water equivalent—which is the more remarkable, since the snowfall of China proper is heavy for so low a latitude. As regards summer deluges it may be noted that at Chang-hai, on the 5th of July, 1906, there fell during a tornado as much as 1.8 inches of rain in less than a quarter of an hour.

L.C.W.B.

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*Ergebnisse zehnjähriger Registrirungen des Regenfalls in Nord-deutschland.* Von [Results of ten years' Rainfall Registration in North Germany] G. HELLMANN. (Veröffentlichungen des Königlich Preussischen Meteorologischen Instituts, Nr. 252.) Berlin, 1912. Size  $13\frac{1}{2} \times 10$ , pp. 36. Price 3 marks.

THIS publication discusses in numerous curves and tables, together with explanatory text, the rainfall at various places in North Germany, more especially during the five summer months, May to September.

Dr. Hellmann distinguishes two classes of summer rains—the widespread and long-continued precipitation produced by the condensation of water vapour, which has for the most part been transported in a barometric depression from the sea by wind, and the shorter

thunder rains which proceed mainly or considerably from water evaporated *in situ*, or in the same neighbourhood as that in which it falls again. He is careful, of course, to point out that one type may merge into the other, so that no rigid separation of the two is possible, and we know in England how impossible it often is to decide whether a given June downpour should be called "cyclonic" or "thunderstorm," only the more extreme forms of each being readily distinguishable. Falls of soft hail appear to be common in Germany, as in England, in April and May; whilst the thunderstorms that occur in May and June are more often accompanied by true hail than those which occur during the later summer months.

Thunderstorm rains are responsible for half the quantity of rain falling from May to September. On the coast the percentage is less, but in the mountain regions of central Germany it rises to seventy-five.

Thunderstorm rains of great intensity are especially frequent in the dry regions of eastern Germany, where the summer heat is very great, and "cloud-bursts" may precipitate 9 centimetres (between 3 and four inches) in an hour. More than a decade, however, may elapse before so violent a fall is repeated at the same spot, and it would not appear that the thunder rains of Germany are any more severe than those which occur in the same latitude of England, where a balance may be struck by the circumstance that if the summer temperature is less than in Germany the vapour supply necessary for heavy rain is greater.

L.C.W.B.

*Die Eiszeiten und Polschwankungen der Erde.* Von [The Ice-Age and Variations of Latitude over the Earth's Surface] Prof. RUDOLF SPITALER. (Aus den Sitzungsberichten der kaiserl. Akademie der Wissenschaften in Wien. Mathem.-naturaw.-klasse. Bd. cxxi. Abt. IIa. November, 1912). Vienna, 1912. Size  $9\frac{1}{2} \times 6$ , pp. 49.

THIS is a mathematical treatise discussing the effects of accumulations of ice in past ages upon the Earth's polar movements. Certain geologic processes, like extensive glaciation over the continents, and the uplifting of mountain masses, cause an alteration in the lie of the axis of inertia of the Earth (Trägheitspol), and as the Earth, with the rigidity of steel, is only slightly adaptable to changes of form, the pole of inertia becomes in consequence separated a little from the pole of rotation (Rotationspol), which then describes a cycloidal movement round the former with a period of over 400 days, so long as the process of adaptation continues. The author calculates that the glaciation of Europe and North America in the Quaternary epoch caused the pole of inertia to move 1' or 1852 metres towards the meridian of 115° E. These disturbances in equilibrium set up stresses and strains in the crust of the Earth involving important tectonic changes, and the independent testimony of geologists supports the author's conclusions that the Ice ages were periods of greater crust folding than the genial periods.

L.C.W.B.

## RAINFALL TABLE FOR MAY, 1913.

| 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. | 1913.<br>in. |
| Camden Square.....                   | London.....          | 51 32      | 0 8                  | 111                            | 1'75                           | 1'72         |
| Tenterden.....                       | Kent.....            | 51 4       | *0 41                | 190                            | 1'65                           | '84          |
| Arundel (Patching).....              | Sussex.....          | 50 51      | 0 27                 | 130                            | 1'80                           | 2'90         |
| Fawley (Cadland).....                | Hampshire.....       | 50 50      | 1 22                 | 52                             | 1'96                           | 2'72         |
| Oxford (Magdalen College).....       | Oxfordshire.....     | 51 45      | 1 15                 | 186                            | 1'81                           | 2'21         |
| Wellingborough (Croyland Abbey)..... | Northampton.....     | 52 18      | 0 41                 | 174                            | 1'99                           | 1'66         |
| Shoeburyness.....                    | Essex.....           | 51 31      | *0 48                | 13                             | 1'27                           | 1'30         |
| Bury St. Edmunds (Westley).....      | Suffolk.....         | 52 15      | *0 40                | 226                            | 1'93                           | 2'17         |
| Geldeston [Beccles].....             | Norfolk.....         | 52 27      | *1 31                | 38                             | 1'78                           | 1'49         |
| Polapit Tamar [Launceston].....      | Devon.....           | 50 40      | 4 22                 | 315                            | 2'08                           | 3'15         |
| Rousdon [Lyme Regis].....            | ".....               | 50 41      | 3 0                  | 516                            | 2'02                           | 2'85         |
| Stroud (Upfield).....                | Gloucestershire..    | 51 44      | 2 13                 | 226                            | 2'10                           | 2'51         |
| Church Stretton (Wolstaston).....    | Shropshire.....      | 52 35      | 2 48                 | 800                            | 2'64                           | 3'56         |
| Coventry (Kingswood).....            | Warwickshire.....    | 52 24      | 1 30                 | 340                            | 2'15                           | 2'06         |
| Boston.....                          | Lincolnshire.....    | 52 58      | 0 1                  | 11                             | 1'80                           | 2'12         |
| Worksoy (Hodsock Priory).....        | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 2'08                           | 1'73         |
| Macclesfield.....                    | Cheshire.....        | 53 15      | 2 7                  | 501                            | 2'43                           | 2'97         |
| Southport (Hesketh Park).....        | Lancashire.....      | 53 38      | 2 59                 | 38                             | 2'13                           | 2'24         |
| Arncliffe Vicarage.....              | Yorkshire, W.R.....  | 54 8       | 2 6                  | 732                            | 3'55                           | 2'72         |
| Wetherby (Ribston Hall).....         | ".....               | 53 59      | 1 24                 | 130                            | 2'09                           | 1'57         |
| Hull (Pearson Park).....             | "..... E.R.....      | 53 45      | 0 20                 | 6                              | 1'98                           | 2'30         |
| Newcastle (Town Moor).....           | Northumberland.....  | 54 59      | 1 38                 | 201                            | 2'04                           | 2'09         |
| Borrowdale (Seathwaite).....         | Cumberland.....      | 54 30      | 3 10                 | 423                            | 7'50                           | 7'18         |
| Cardiff (Ely).....                   | Glamorgan.....       | 51 29      | 3 13                 | 53                             | 2'56                           | 3'16         |
| Haverfordwest.....                   | Pembroke.....        | 51 48      | 4 58                 | 90                             | 2'62                           | 4'06         |
| Aberystwyth (Gogerddan).....         | Cardigan.....        | 52 26      | 4 1                  | 83                             | 2'63                           | 4'60         |
| Llandudno.....                       | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 1'86                           | 2'11         |
| Cargen [Dumtries].....               | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 2'87                           | 4'88         |
| Marchmont House.....                 | Berwick.....         | 55 44      | 2 24                 | 498                            | 2'53                           | 2'48         |
| Girvan (Pinmore).....                | Ayr.....             | 55 10      | 4 49                 | 207                            | 2'98                           | 3'95         |
| Glasgow (Queen's Park).....          | Renfrew.....         | 55 53      | 4 18                 | 144                            | 2'40                           | 2'68         |
| Inveraray (Newtown).....             | Argyll.....          | 56 14      | 5 4                  | 17                             | 3'53                           | 6'32         |
| Mull (Quinish).....                  | ".....               | 56 34      | 6 13                 | 35                             | 2'99                           | 3'83         |
| Dundee (Eastern Necropolis).....     | Forfar.....          | 56 28      | 2 57                 | 199                            | 2'05                           | 3'55         |
| Braemar.....                         | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | 2'33                           | 4'11         |
| Aberdeen (Cranford).....             | ".....               | 57 8       | 2 7                  | 120                            | 2'40                           | 3'65         |
| Cawdor.....                          | Nairn.....           | 57 31      | 3 57                 | 250                            | 2'07                           | 1'07         |
| Fort Augustus (S. Benedict's).....   | E. Inverness.....    | 57 9       | 4 41                 | 68                             | 2'36                           | 2'57         |
| Loch Torridon (Bendamph).....        | W. Ross.....         | 57 32      | 5 32                 | 20                             | 4'54                           | 5'22         |
| Dunrobin Castle.....                 | Sutherland.....      | 57 59      | 3 56                 | 14                             | 2'19                           | 2'07         |
| Wick.....                            | Caithness.....       | 58 26      | 3 6                  | 77                             | 2'04                           | 1'70         |
| Killarney (District Asylum).....     | Kerry.....           | 52 4       | 9 31                 | 178                            | 3'05                           | 4'91         |
| Waterford (Brook Lodge).....         | Waterford.....       | 52 15      | 7 7                  | 104                            | 2'33                           | 4'19         |
| Nenagh (Castle Lough).....           | Tipperary.....       | 52 54      | 8 24                 | 120                            | 2'51                           | 3'94         |
| Ennistymon House.....                | Clare.....           | 52 57      | 9 18                 | 37                             | 2'70                           | 3'81         |
| Gorey (Courtown House).....          | Wexford.....         | 52 40      | 6 13                 | 80                             | 2'24                           | 3'35         |
| Abbey Leix (Blandsfort).....         | Queen's County.....  | 52 56      | 7 17                 | 532                            | 2'43                           | 4'16         |
| Dublin (Fitz William Square).....    | Dublin.....          | 53 21      | 6 14                 | 54                             | 2'07                           | 2'80         |
| Mullingar (Belvedere).....           | Westmeath.....       | 53 29      | 7 22                 | 367                            | 2'51                           | 3'52         |
| Crossmolina (Enniscoe).....          | Mayo.....            | 54 4       | 9 16                 | 74                             | 3'17                           | 5'29         |
| Cong (The Glebe).....                | ".....               | 53 33      | 9 16                 | 112                            | 2'94                           | 4'64         |
| Collooney (Markree Obsy.).....       | Sligo.....           | 54 11      | 8 27                 | 127                            | 2'80                           | 4'25         |
| Seaforde.....                        | Down.....            | 54 19      | 5 50                 | 180                            | 2'72                           | 3'54         |
| Bushmills (Dundarave).....           | Antrim.....          | 55 12      | 6 30                 | 162                            | 2'37                           | 2'75         |
| Omagh (Edenfel).....                 | Tyrone.....          | 54 36      | 7 18                 | 280                            | 2'66                           | 4'15         |

RAINFALL TABLE FOR MAY, 1913—*continued.*

| RAINFALL OF MONTH ( <i>con.</i> ) |          |                   |       |             | 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.      | 1913. | Diff. from Aver. in. | % of Av. |                        |                 |
|                                   |          | in.               | Date. |             | in.                   | in.   |                      |          | in.                    |                 |
| — .03                             | 98       | .60               | 29    | 11          | 8.68                  | 10.09 | +1.41                | 116      | 25.11                  | Camden Square   |
| — .81                             | 51       | .20               | 3     | 10          | 9.41                  | 11.89 | +2.48                | 126      | 27.64                  | Tenterden       |
| +1.10                             | 161      | .96               | 12    | 11          | 10.33                 | 15.98 | +5.65                | 155      | 30.48                  | Patching        |
| + .76                             | 139      | .64               | 30    | 12          | 11.14                 | 15.79 | +4.65                | 142      | 31.87                  | Cadland         |
| + .40                             | 122      | .53               | 3     | 15          | 8.33                  | 10.93 | +2.60                | 131      | 24.58                  | Oxford          |
| — .33                             | 83       | .61               | 3     | 11          | 9.04                  | 10.97 | +1.93                | 121      | 25.17                  | Croyland Abbey  |
| + .03                             | 102      | .38               | 27    | 9           | 6.23                  | 7.79  | +1.56                | 125      | 19.28                  | Shoeburyness    |
| + .24                             | 112      | .80               | 3     | 7           | 8.55                  | 9.74  | +1.19                | 114      | 25.40                  | Westley         |
| — .29                             | 84       | .47               | 29    | 11          | 7.84                  | 8.52  | + .68                | 109      | 23.73                  | Geldeston       |
| +1.07                             | 151      | .80               | 7     | 19          | 13.70                 | 22.43 | +8.73                | 164      | 38.27                  | Polapit Tamar   |
| + .83                             | 141      | .50               | 7     | 17          | 12.15                 | 16.70 | +4.55                | 137      | 33.54                  | Rousdon         |
| + .41                             | 120      | .43               | 4     | 13          | 10.65                 | 16.17 | +5.52                | 152      | 29.81                  | Stroud          |
| + .92                             | 135      | .67               | 3     | 18          | 11.71                 | 20.00 | +8.29                | 170      | 32.41                  | Wolstaston      |
| — .09                             | 96       | .81               | 3     | 12          | 10.23                 | 15.28 | +5.05                | 149      | 28.98                  | Coventry        |
| + .32                             | 118      | .47               | 3, 8  | 15          | 7.91                  | 9.76  | +1.85                | 123      | 23.35                  | Boston          |
| — .35                             | 83       | .62               | 6     | 9           | 8.74                  | 10.53 | +1.79                | 120      | 24.46                  | Hodsock Priory  |
| + .54                             | 122      | .76               | 3     | 18          | 11.91                 | 15.88 | +3.97                | 133      | 34.73                  | Macclesfield    |
| + .11                             | 105      | .66               | 3     | 19          | 10.70                 | 13.67 | +2.97                | 128      | 32.70                  | Southport       |
| — .83                             | 77       | .56               | 3     | 16          | 23.59                 | 33.52 | +9.93                | 142      | 61.49                  | Arneliffe       |
| — .52                             | 75       | .42               | 7     | 11          | 9.46                  | 10.63 | +1.17                | 112      | 26.87                  | Ribston Hall    |
| + .32                             | 116      | .58               | 8     | 15          | 8.99                  | 10.85 | +1.86                | 121      | 26.42                  | Hull            |
| + .05                             | 102      | .69               | 6     | 15          | 9.51                  | 13.07 | +3.56                | 137      | 27.94                  | Newcastle       |
| — .32                             | 96       | 1.01              | 3     | 21          | 49.44                 | 63.72 | +14.28               | 129      | 129.48                 | Seathwaite      |
| + .60                             | 123      | .39               | 11    | 18          | 14.67                 | 23.79 | +9.12                | 162      | 42.28                  | Cardiff         |
| +1.44                             | 155      | 1.20              | 7     | 18          | 16.71                 | 25.45 | +8.74                | 152      | 46.81                  | Haverfordwest   |
| +1.97                             | 175      | .71               | 3     | 21          | 15.15                 | 25.87 | +10.72               | 171      | 45.46                  | Gogerddan       |
| + .25                             | 113      | .40               | 3     | 21          | 10.40                 | 13.46 | +3.06                | 130      | 30.36                  | Llandudno       |
| +2.01                             | 170      | 1.00              | 13    | 21          | 16.22                 | 25.88 | +9.66                | 159      | 43.47                  | Cargen          |
| — .05                             | 98       | .56               | 8     | 14          | 12.00                 | 12.61 | + .61                | 105      | 33.76                  | Marchmont       |
| + .97                             | 132      | .65               | 6     | 22          | 18.06                 | 21.54 | +3.48                | 119      | 49.77                  | Girvan          |
| + .28                             | 112      | .63               | 8     | 22          | 13.10                 | 16.48 | +3.38                | 126      | 35.97                  | Glasgow         |
| +2.79                             | 179      | 1.00              | 6     | 24          | 25.68                 | 32.25 | +6.57                | 125      | 68.67                  | Inveraray       |
| + .84                             | 128      | .85               | 20    | 22          | 20.25                 | 26.28 | +6.03                | 130      | 56.57                  | Quinish         |
| +1.50                             | 173      | .95               | 9     | 15          | 9.96                  | 13.18 | +3.22                | 132      | 28.64                  | Dundee          |
| +1.78                             | 176      | 1.41              | 8     | 15          | 12.97                 | 19.05 | +6.08                | 147      | 34.93                  | Braemar         |
| +1.25                             | 152      | 1.35              | 9     | 14          | 12.00                 | 14.35 | +2.35                | 120      | 32.73                  | Aberdeen        |
| —1.00                             | 52       | .25               | 3     | 9           | 10.38                 | 8.33  | —2.05                | 80       | 29.33                  | Cawdor          |
| + .21                             | 109      | .52               | 3     | 21          | 18.15                 | 20.76 | +2.61                | 114      | 44.53                  | Fort Augustus   |
| + .68                             | 115      | .92               | 20    | 17          | 33.48                 | 37.00 | +3.52                | 110      | 83.93                  | Bendamp         |
| — .12                             | 95       | .47               | 9     | 18          | 12.18                 | 8.42  | —3.76                | 69       | 31.90                  | Dunrobin Castle |
| — .34                             | 83       | .27               | 23    | 18          | 10.88                 | 8.77  | —2.11                | 81       | 29.88                  | Wick            |
| +1.86                             | 161      | .98               | 7     | 22          | 21.95                 | 28.86 | +6.91                | 131      | 54.81                  | Killarney       |
| +1.86                             | 180      | .73               | 7     | 15          | 14.61                 | 21.91 | +7.30                | 150      | 39.57                  | Waterford       |
| +1.43                             | 157      | .76               | 7     | 20          | 14.81                 | 21.78 | +6.97                | 147      | 39.43                  | Castle Lough    |
| +1.11                             | 141      | .61               | 2     | 22          | 16.49                 | 22.51 | +6.02                | 137      | 46.52                  | Ennistymon      |
| +1.11                             | 150      | .61               | 5     | 16          | 12.83                 | 18.31 | +5.48                | 142      | 34.99                  | Courtown Ho.    |
| +1.73                             | 171      | .70               | 7     | 18          | 13.26                 | 20.63 | +7.37                | 155      | 35.92                  | Abbey Leix      |
| + .73                             | 135      | .67               | 5     | 17          | 10.15                 | 13.90 | +3.75                | 137      | 27.68                  | Dublin          |
| +1.01                             | 140      | .52               | 2, 7  | 23          | 13.29                 | 19.57 | +6.28                | 147      | 36.15                  | Mullingar.      |
| +2.12                             | 167      | .64               | 10    | 22          | 20.21                 | 29.52 | +9.31                | 146      | 52.87                  | Enniscoe        |
| +1.70                             | 158      | .56               | 8     | 25          | 18.23                 | 27.09 | +8.86                | 148      | 48.90                  | Cong            |
| +1.45                             | 152      | .64               | 8     | 25          | 15.72                 | 22.68 | +6.96                | 144      | 42.71                  | Markree         |
| + .82                             | 130      | .61               | 5     | 21          | 14.54                 | 18.56 | +4.02                | 128      | 38.91                  | Seaforde        |
| + .38                             | 116      | .50               | 6     | 17          | 12.93                 | 13.07 | + .14                | 101      | 37.56                  | Dundarave       |
| +1.49                             | 156      | .52               | 5     | 22          | 14.28                 | 19.80 | +5.52                | 139      | 39.38                  | Omagh           |



## SUPPLEMENTARY RAINFALL, MAY, 1913.

| Div.  | STATION.                      | Rain<br>inches | Div.   | STATION.                      | Rain<br>inches. |
|-------|-------------------------------|----------------|--------|-------------------------------|-----------------|
| II.   | Warlingham, Redvers Road..    | 1·50           | XI.    | Lligwy .....                  | 2·08            |
| „     | Ramsgate .....                | 1·16           | „      | Douglas .....                 | 2·90            |
| „     | Hailsham .....                | ·86            | XII.   | Stoneykirk, Ardwell House...  | 3·63            |
| „     | Totland Bay, Aston House...   | 2·81           | „      | Dalry, The Old Garroch.....   | 5·57            |
| „     | Stockbridge, Ashley .....     | 2·25           | „      | Beattock, Kinnelhead .....    | 4·43            |
| „     | Grayshott .....               | 3·44           | „      | Langholm, Drove Road .....    | 3·14            |
| „     | Caversham, Rectory Road ...   | 3·19           | XIII.  | Meggat Water, Cramilt Lodge   | 3·70            |
| III.  | Harrow Weald, Hill House...   | 1·49           | „      | North Berwick Reservoir...    | 2·27            |
| „     | Pitsford, Sedgebrook.....     | 1·57           | „      | Edinburgh, Royal Observaty.   | 1·18            |
| „     | Woburn, Milton Bryant.....    | 2·07           | XIV.   | Maybole, Knockdon Farm ...    | 3·00            |
| „     | Chatteris, The Priory.....    | 2·05           | XV.    | Ballachulish House .....      | 6·02            |
| IV.   | Colchester, Hill Ho., Lexden  | 1·56           | „      | Campbeltown, Witchburn ..     | 4·08            |
| „     | Newport, Belmont House .....  | 1·39           | „      | Holy Loch, Ardnadam.....      | 5·63            |
| „     | Ipswich, Rookwood, Copdock    | 1·53           | „      | Islay, Eallabus .....         | 3·80            |
| „     | Blakeney .....                | 1·46           | „      | Tiree, Cornaigmore .....      | 3·71            |
| „     | Swaffham .....                | 2·00           | XVI.   | Dollar Academy .....          | 3·26            |
| V.    | Bishops Cannings .....        | 2·65           | „      | Balquhidder, Stronvar.....    | 6·64            |
| „     | Winterbourne Steepleton.....  | ...            | „      | Glenlyon, Meggernie Castle..  | 7·66            |
| „     | Ashburton, Druid House.....   | 4·12           | „      | Blair Atholl .....            | 4·01            |
| „     | Cullompton .....              | 3·65           | „      | Coupar Angus .....            | 5·20            |
| „     | Lynmouth, Rock House .....    | 2·66           | „      | Montrose, Sunnyside Asylum.   | 3·52            |
| „     | Okehampton, Oaklands.....     | 2·43           | XVII.  | Alford, Lynturk Manse .....   | 4·76            |
| „     | Hartland Abbey.....           | 2·82           | „      | Fyvie Castle .....            | 4·36            |
| „     | Probus, Lamellyn.....         | 3·29           | „      | Keith Station ..              | 4·61            |
| „     | North Cadbury Rectory.....    | 2·79           | XVIII. | Alvey Manse .....             | 1·54            |
| VI.   | Clifton, Pembroke Road.....   | 2·70           | „      | Loch Quoich, Loan .....       | 11·05           |
| „     | Ross, The Graig .....         | 2·19           | „      | Drumnadrochit .....           | 1·42            |
| „     | Shifnal, Hatton Grange.....   | 2·37           | „      | Skye, Dunvegan .....          | 5·14            |
| „     | Droitwich .....               | 2·52           | „      | N. Uist, Lochmaddy .....      | 3·08            |
| „     | Blockley, Upton Wold.....     | 2·68           | „      | Glencarron Lodge .....        | 5·37            |
| VII.  | Market Overton.....           | 2·20           | XIX.   | Invershin .....               | 2·76            |
| „     | Market Rasen .....            | 1·89           | „      | Melvich .....                 | 2·21            |
| „     | Bawtry, Hesley Hall .....     | 1·59           | „      | Loch Stack, Ardochullin ..... | 5·48            |
| „     | Derby, Midland Railway.....   | 2·11           | XX.    | Sibbieren Rectory .....       | 5·12            |
| „     | Buxton .....                  | 3·09           | „      | Dunmanway, The Rectory ..     | 5·55            |
| VIII. | Nantwich, Dorfold Hall .....  | 1·83           | „      | Glanmire, Lota Lodge, No. 1   | 4·56            |
| „     | Chatburn, Middlewood .....    | 3·38           | „      | Mitchelstown Castle.....      | 4·34            |
| „     | Cartmel, Flookburgh .....     | 3·08           | „      | Darrynane Abbey .....         | 6·65            |
| IX.   | Langsett Moor, Up. Midhope    | 2·58           | „      | Clonmel, Bruce Villa .....    | 4·47            |
| „     | Scarborough, Scalby .....     | 2·74           | „      | Newmarket-on-Fergus, Fenloe   | 3·72            |
| „     | Ingleby Greenhow .....        | 1·92           | XXI.   | Laragh, Glendalough .....     | 6·87            |
| „     | Mickleton .....               | 2·80           | „      | Ballycumber, Moorock Lodge    | 3·05            |
| X.    | Bellingham, High Green Manor  | 2·79           | „      | Balbriggan, Ardgillan .....   | 3·04            |
| „     | Ilderton, Lilburn Cottage ... | 3·18           | XXII.  | Woodlawn .....                | 4·02            |
| „     | Keswick, The Bank.....        | 1·75           | „      | Westport, St. Helens ..       | 4·97            |
| XI.   | Llanfrechfa Grange .....      | ...            | „      | Dugort, Slievemore Hotel ...  | 5·34            |
| „     | Treherbert, Tyn-y-waun .....  | 5·56           | „      | Mohill Rectory ..             | 4·90            |
| „     | Carmarthen, The Friary .....  | 3·88           | XXIII. | Enniskillen, Portora.....     | 3·66            |
| „     | Castle Malgwyn [Llechryd]...  | 3·94           | „      | Dartrey [Cootehill] .....     | 3·84            |
| „     | Crickhowell, Tal-y-naes.....  | 5·20           | „      | Warrenpoint, Manor House ..   | ...             |
| „     | New Radnor, Ednol .....       | 4·18           | „      | Banbridge, Milltown .....     | 3·27            |
| „     | Birmingham WW., Tyrmynydd     | 3·23           | „      | Belfast, Cave Hill Road ..... | 4·01            |
| „     | Lake Vyrnwy .....             | 2·71           | „      | Glenarm Castle.....           | 2·32            |
| „     | Llangyhanfal, Plâs Draw.....  | 2·92           | „      | Londonderry, Creggan Res...   | 3·04            |
| „     | Dolgelly, Bryntirion.....     | 3·81           | „      | Dunfanaghy, Horn Head ...     | 3·20            |
| „     | Bettws-y-Coed, Tyn-y-bryn...  | 2·05           | „      | Killybegs .....               | 4·50            |

## METEOROLOGICAL NOTES ON MAY, 1913.

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.—Changeable weather throughout the early part, showery conditions alternating with fine, sunny weather. Brilliant weather in the latter part, with unprecedented warmth in the last week (see p. 88). Heavy TS in early morning of 30th with  $\cdot 27$  in. of R in 10 minutes. Mean temp.  $56^{\circ}\cdot 7$  or  $2^{\circ}\cdot 7$  above the average. Duration of sunshine  $189\cdot 0^*$  hours, and of R  $25\cdot 5$  hours. Evaporation  $2\cdot 49$  in. Shade max.  $84^{\circ}\cdot 4$  on 26th; min.  $35^{\circ}\cdot 3$  on 7th. F 0, f 0.

TENTERDEN.—A dry month, and the last week fine and hot. Temp. above  $74^{\circ}$  each day from 24th to 30th. Duration of sunshine  $233\cdot 0^{\dagger}$  hours. Shade max.  $79^{\circ}\cdot 7$  on 27th; min.  $35^{\circ}\cdot 0$  on 7th. F 0, f 3.

TOTLAND BAY.—Duration of sunshine  $239\cdot 1^*$  hours or  $14\cdot 8$  hours above the average. Shade max.  $76^{\circ}\cdot 2$  on 26th; min.  $38^{\circ}\cdot 9$  on 4th. F 0, f 0.

MILTON BRYAN.—A very drying month with cold E. winds which blew strongly from 14th to 19th. Hot from 24th to 30th.

IPSWICH, COPDOCK.—Dull, wet and chilly until 11th, after which a week of N. and E. winds dried everything up. The last week was brilliant and warm. Mean temp.  $54^{\circ}\cdot 7$ . Duration of sunshine  $217\cdot 6^{\dagger}$  hours. Shade max.  $79^{\circ}\cdot 5$  on 26th; min.  $37^{\circ}\cdot 4$  on 6th. F 0, f 2.

POLAPIT TAMAR.—The first fortnight was excessively wet and cold as well as sunless. Of the total R  $2\cdot 66$  in. fell in the first 13 days. Shade max.  $77^{\circ}\cdot 3$  on 26th; min.  $36^{\circ}\cdot 9$  on 2nd. F 0, f 1.

ROSS.—A long spell of wet weather gave way on 12th, and the rest of the month was generally dry, fine and hot. Unusually hot from 25th to 27th. Shade max.  $81^{\circ}\cdot 3$  on 26th; min.  $34^{\circ}\cdot 2$  on 2nd.

HODSOCK PRIORY.—A mild but cloudy month, with a warm week at the end. The dry weather after the 8th was very welcome, and corn and grass crops have much improved. Shade max.  $77^{\circ}\cdot 8$  on 30th; min.  $33^{\circ}\cdot 9$  on 7th. F 0, f 8.

SOUTHPORT.—Duration of sunshine  $152\cdot 2^*$  hours or  $66\cdot 0$  hours below the average. Duration of R  $53\cdot 7$  hours. Evaporation  $2\cdot 43$  in. Mean temp.  $51^{\circ}\cdot 2$ . Shade max.  $74^{\circ}\cdot 0$  on 30th; min.  $34^{\circ}\cdot 0$  on 7th and 16th. F 0, f 6.

HULL.—Dull, with persistent R at beginning; fine from 11th and 17th; again unsettled but warmer to the end. TS on night of 29th. Shade max.  $80^{\circ}\cdot 0$  on 30th; min.  $36^{\circ}\cdot 0$  on 17th. F 0, f 2.

CARMARTHEN.—Cold and wet. Corn sowing unusually late owing to continued wet. Hay prospects good, but fruit crop very poor.

LLANDUDNO.—Shade max.  $74^{\circ}\cdot 0$  on 30th; min.  $38^{\circ}\cdot 0$  on 7th and 16th.

EDINBURGH.—Shade max.  $73^{\circ}\cdot 7$  on 30th; min.  $36^{\circ}\cdot 1$  on 19th. F 0, f 2.

ARDNADAM.—Disagreeably wet, with cold winds and very chilly evenings. Only 8 days with shade temp. above  $60^{\circ}$ . Shade max.  $65^{\circ}\cdot 2$  on 13th; min.  $36^{\circ}\cdot 8$  on 2nd. F 0, f 0.

COUPAR ANGUS.—Heavy floodings, the flood mark being higher than previously known. Shade max.  $70^{\circ}\cdot 0$  on 30th; min.  $34^{\circ}\cdot 0$  on 13th.

LOCH STACK.—Duration of sunshine  $114\cdot 6^*$  hours.

DARRYNANE ABBEY.—The wettest May in 34 years.

WATERFORD.—The wettest May since 1878. Shade max.  $69^{\circ}\cdot 5$  on 26th; min.  $34^{\circ}\cdot 0$  on 7th.

ARDGILLAN.—R  $1\cdot 16$  in. above the average. Shade max.  $67^{\circ}\cdot 9$  on 24th; min  $35^{\circ}\cdot 3$  on 5th. F 0, f 1.

BANBRIDGE, MILLTOWN.—R  $\cdot 99$  in. above the average of 50 years.

\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, December, 1912.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |        |          |       | Average. |       |               |           | Absolute.       |                   | Total Rain  |       | Aver.<br>Cloud. |
|------------------------------------------------------------------|-----------|--------|----------|-------|----------|-------|---------------|-----------|-----------------|-------------------|-------------|-------|-----------------|
|                                                                  | 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                                            | 56°·8     | 14     | 23°·4    | 1     | 50°·8    | 40°·1 | 43°·1         | 89        | 69°·6           | 18°·8             | inches 2·80 | 18    | 8·8             |
| Malta ... ..                                                     | 65°·7     | 1      | 49°·5    | 4     | 60°·7    | 53°·7 | 50°·1         | 82        | 128°·0          | ..                | ·98         | 9     | 5·6             |
| Lagos ... ..                                                     | 90°·3     | 5      | 70°·0    | 20    | 88°·3    | 74°·4 | 72°·5         |           | 148°·0          | 68°·0             | ·00         | 0     | 3·7             |
| Cape Town ... ..                                                 | 93°·4     | 24     | 50°·1    | 9     | 79°·3    | 60°·2 | 57°·3         | 3         | ...             | ...               | ·06         | 2     | 2·2             |
| Natal, Durban ... ..                                             | 87°·0     | 28     | 57°·2    | 21    | 77°·4    | 66°·1 | 67°·1         | 82        | 161°·0          | ...               | 9·77        | 16    | ·61             |
| Johannesburg ... ..                                              | 85°·4     | 11     | 45°·4    | 24    | 75°·7    | 54°·3 | 55°·8         | 79        | 153°·9          | 45°·5             | 4·81        | 15    | 4·7             |
| Mauritius ... ..                                                 | 89°·6     | 22     | 61°·7    | 6     | 85°·5    | 68°·5 | 67°·0         | 74        | 158°·5          | 57°·2             | 4·82        | 16    | 6·4             |
| Bloemfontein ... ..                                              | 93°·8     | 17     | 45°·5    | 20    | 85°·2    | 59°·3 | 50°·6         | 64        | ...             | ...               | 2·87        | 11    | 3·5             |
| Calcutta... ..                                                   | 81°·9     | 20     | 52°·5    | 16    | 77°·1    | 55°·2 | 54°·6         | 69        | ...             | 45°·9             | ·00         | 0     | 0·7             |
| Bombay... ..                                                     | 87°·1     | 3      | 67°·3    | 27    | 85°·0    | 70°·7 | 65°·9         | 69        | 130°·6          | 59°·7             | ·00         | 0     | 1·3             |
| Madras ... ..                                                    | 84°·8     | 23, 29 | 63°·9    | 26    | 83°·4    | 68°·4 | 66°·6         | 76        | 138°·4          | 63°·5             | ·30         | 2     | 3·4             |
| Kodaikanal ... ..                                                | 70°·8     | 24     | 40°·9    | 11    | 64°·2    | 47°·8 | 42°·1         | 63        | 133°·1          | 29°·8             | 5·25        | 11    | 4·6             |
| Colombo, Ceylon ... ..                                           | 87°·5     | 14*    | 71°·3    | 27    | 85°·3    | 73°·5 | 70°·8         | 76        | 151°·0          | 64°·3             | 4·21        | 11    | 5·5             |
| Hongkong ... ..                                                  | 75°·3     | 14     | 45°·3    | 28    | 66°·2    | 57°·2 | 53°·3         | 74        | 117°·5          | ...               | 4·90        | 8     | 6·7             |
| Sydney ... ..                                                    | 92°·9     | 18     | 52°·1    | 13    | 77°·2    | 63°·3 | 57°·6         | 64        | 149°·9          | 44°·0             | 2·11        | 19    | 6·3             |
| Melbourne ... ..                                                 | 102°·0    | 22     | 44°·0    | 11    | 72°·5    | 53°·9 | 49°·8         | 61        | 151°·2          | 39°·2             | 3·56        | 12    | 5·1             |
| Adelaide ... ..                                                  | 105°·4    | 17     | 49°·8    | 4     | 82°·2    | 58°·6 | 52°·0         | 47        | 159°·0          | 41°·7             | 1·60        | 8     | 3·3             |
| Perth ... ..                                                     | 104°·1    | 11     | 48°·3    | 1     | 80°·6    | 60°·8 | 55°·7         | 59        | 167°·1          | 43°·9             | ·43         | 9     | 4·1             |
| Coolgardie ... ..                                                | 111°·0    | 16     | 50°·7    | 22    | 95°·5    | 63°·7 | 49°·6         | 31        | 175°·8          | 48°·4             | ·24         | 5     | 3·4             |
| Hobart, Tasmania ... ..                                          | 90°·2     | 14     | 41°·9    | 12    | 69°·7    | 51°·5 | 47°·3         | 60        | 153°·0          | 39°·0             | 2·07        | 12    | 6·4             |
| Wellington ... ..                                                | 66°·2     | 26     | 43°·0    | 10    | 60°·9    | 50°·7 | 48°·2         | 76        | 141°·2          | 35°·2             | 5·87        | 20    | 7·7             |
| Auckland ... ..                                                  | 75°·5     | 26     | 49°·5    | 6     | 69°·4    | 56°·3 | 55°·1         | 78        | 133°·6          | 45°·0             | ·81         | 7     | 5·8             |
| Jamaica, Kingston ... ..                                         | 90°·1     | 30     | 7°·3     | 31    | 87°·3    | 69°·8 | 68°·6         | 81        | ...             | ...               | ·08         | 1     | 1·1             |
| Grenada ... ..                                                   | 85°·0     | 15     | 71°·0    | 13    | 83°·0    | 73°·5 | ...           | 78        | 139°·0          | ...               | 9°·04       | 24    | 4°·0            |
| Toronto ... ..                                                   | 56°·4     | 6      | 11°·2    | 9     | 38°·8    | 26°·5 | ...           | 81        | 103°·7          | 6°·0              | 1·85        | 17    | 7°·0            |
| Fredericton ... ..                                               | 48°·0     | 2, 3   | —7°·0    | 13    | 31°·5    | 13°·0 | 18°·8         | 85        | ...             | ...               | 4°·74       | 12    | 5°·0            |
| St. John, N.B. ... ..                                            | 52°·5     | 19     | 3°·7     | 13    | 35°·9    | 21°·1 | 22°·0         | 74        | ...             | ...               | 7°·38       | 14    | 4°·7            |
| Edmonton, Alberta ... ..                                         | 55°·0     | 8      | —15°·8   | 1     | 32°·1    | 13°·8 | ...           | 75        | 92°·9           | —16°·7            | ·10         | 5     | 4°·9            |
| Victoria, B.C. ... ..                                            | 49°·6     | 13     | 31°·4    | 19    | 44°·8    | 38°·1 | 39°·0         | 90        | ...             | ...               | 5°·84       | 19    | 8°·1            |

\* 15 and 29.

MALTA.—Mean temp. of air 56°·0. Average daily sunshine 5·1 hours.

Johannesburg.—Bright sunshine 245·9 hours.

Mauritius.—Mean. hourly velocity of wind 8·6 miles or 0·9 miles below average.

KODAIKANAL.—Bright sunshine 217 hours.

COLOMBO.—Mean temp. of air 79°·4 or 0°·4 above, and R 1·03 in. below, averages.  
Mean velocity of wind 7·3 miles per hour. TSS on 11 days.HONGKONG.—Mean temp. of air 61°·4. Mean hourly velocity of wind 12°·0 miles.  
Bright sunshine 143·9 hours.

Sydney.—Mean temp. of air 0°·1 above, and R ·49 in. below, averages.

Melbourne.—Mean temp. of air 1°·3 below, and R 1·28 in. above, averages.

Adelaide.—Mean temp. of air 0°·7 below, and R ·67 in. above, averages.

Coolgardie.—Mean temp. of air 3°·6 above average.

Hobart.—Mean temp. of air 0°·8 below, and R ·15 in. above, averages.

Wellington.—Mean temp. of air 2°·6 below, and R 2·42 in. above, averages.  
Bright sunshine 170·9 hours. H on 2 days.

# Symons's Meteorological Magazine.

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## THE AUSTRALIAN ANTARCTIC EXPEDITION.

THE newspapers have published a message received from Dr. Mawson at his winter camp at Commonwealth Bay, within the Antarctic Circle, on June 23rd. This is the first message that has ever been received from the Antarctic regions at mid-winter, a period when the anxiety of friends of explorers has always been at a maximum; and it is most gratifying to learn that the health and spirits of Dr. Mawson and his companions were reported to be good in the middle of their longest night. A still more interesting and remarkable fact is that daily meteorological reports are being received in Melbourne, both from Commonwealth Bay on the Antarctic Continent, and from Macquarie Island in the Southern Ocean, by which important assistance has been given in framing the weather forecasts for Australia, as much of the bad weather originates in cyclones which travel from the Antarctic regions. We are informed that the station on Macquarie Island has been taken over by the Commonwealth Government, so that it can be expected to become a permanent outpost of weather study, bearing much the same relation to Australia that Iceland does to Europe. It will be remembered that the station set up in the South Orkneys by Mr. R. C. Mossman under the instructions of Dr. W. S. Bruce of the "Scotia" Antarctic Expedition in 1903 was taken over by the Government of the Argentine Republic, and has been at work ever since, although the records can only be transmitted to Buenos Aires once a year, and the results are thus only available for the study of past conditions. We are not aware whether a wireless installation is contemplated for the South Orkneys, though we believe that commercial interest in the whale fishery has made this a practical question, for the neighbouring sub-Antarctic Island of South Georgia, and the Falkland Islands have been for some time in wireless communication with the mainland. No more striking advance in the study of world meteorology has ever been made than this inclusion of the Antarctic regions within the system of daily meteorological weather reports; and meteorologists must pay a tribute of gratitude to Dr. Mawson for his triumphant realisation of what, a very short time ago, would have been held to be a fantastic dream.

Although the appeal by Captain Davis, to which we referred in our last month's issue, has fallen upon evil days in London, on account of the many other interests which call more loudly to the public ear, such as the raising of £90,000 by "The Times" for the purchase of the Crystal Palace, we are happy to learn that an encouraging beginning has been made. Sir Robert Lucas-Tooth has subscribed £1,000, the Royal Geographical Society, Lady Scott, Commander Evans, R.N., of the Scott Expedition, and Mr. T. Y. Buchanan, one of the two survivors of the scientific staff of the *Challenger*, have each subscribed £100, and practically all the members of Captain Scott's recent expedition have given personal donations. The Captain Scott Memorial Fund has set apart £10,000 as a fund for promoting Antarctic research, but no announcement has yet been made of any donation to the expedition at present in the field. We trust that before Captain Davis leaves for Australia this month, the funds so happily inaugurated will be augmented by Government and private donors to an amount which will convey to the Australian public an unmistakable message of congratulation on their success in carrying out scientific investigations of world-wide importance, and encouragement to them to complete the task in which they have gone so far.

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### SYNOPTIC ANTARCTIC METEOROLOGY.

*National Antarctic Expedition, 1901-1904, Meteorology, Part II., comprising Daily Synchronous Charts, 1st October, 1901, to 31st March, 1904, prepared in the Meteorological Office under the superintendence of M. W. CAMPBELL HEPWORTH, C.B., R.D., Commander R.N.R., Marine Superintendent. London: published by the Royal Society, 1913. Size 12 x 9. Pp. 26 + 262 plates.*

THIS volume completes the discussion of the Meteorology of the *Discovery* Expedition of 1901-4, but goes far beyond the work of that expedition, and furnishes for the first time a series of daily synoptic charts for the southern hemisphere south of 30° S., incorporating the Antarctic observations of the expeditions in the *Discovery*, the *Gauss*, the *Scotia* and the *Antarctic*, together with the meteorological logs of all vessels making observations in the southern ocean, as well as records from observatories in the southern portions of the southern continents. The few pages of letterpress include, first, an explanatory statement by Dr. W. N. Shaw addressed to Sir Archibald Geikie, a preface by Sir Archibald Geikie stating the conditions in which the observations were made, the arrangements arrived at by the Committee for their discussion, and a summary of Captain Scott's objections to the treatment of his meteorological data in Volume I., which was reviewed in this Magazine for October,

1908, Vol. 43, p. 165, with a postscript expressing appreciation of Captain Scott's character and achievements. Then follow four pages of remarks on the charts by Captain Campbell Hepworth, in which he points out that the total number of observations charted was 44,893, the greatest number of observations available for any one day being 52 marine for January 22nd, 1903, and 25 land for May 27th, 1909, and the smallest number being 19 marine for October 9th, 1903, and 10 land throughout October, 1901. All observations dealt with were taken at 12 noon, Greenwich mean time, and were thus strictly simultaneous. They are plotted on separate little charts for every day, the thirtieth parallel which bounds the chart being given as a circle  $3\frac{1}{2}$  inches in diameter. In addition, monthly summary charts are given. The area dealt with is greater than has ever been treated in this manner previously, although the very wide spacing of the points of observation makes it impossible to draw the isobars and isotherms as continuous curves, the length and continuity of the curves depending on the number and concentration of the points of observation. Charts are also given for purposes of comparison, showing the mean monthly distribution of temperature and pressure, as well as tables of average wind direction and gale frequency. Captain Hepworth treats of certain conclusions drawn from a study of the charts, which confirm the opinion he had formed as to the region of origin and direction of travel of the cyclones of the southern ocean, derived from the study of ships' logs, published by him in 1891; and he proceeds to deal with a few of the salient features exhibited in the charts of particular days and months. A brief discussion is given of the variation in position of the areas of permanent high pressure in the southern divisions of the three great oceans.

The immense value of this work lies in the data it presents, in a clear and comprehensible form, for the consideration of students of atmospheric circulation, who have hitherto been without means of comparing the march of atmospheric phenomena from day to day and from month to month in the southern hemisphere; and it makes us regret still more the spasmodic and unsystematic manner in which Antarctic research has been allowed to proceed since the days of the *Discovery* Expedition. Had the Committees in Europe been possessed of the enthusiasm and the courage which the explorers in the ice displayed, there seems to us to be little doubt that, with no more expenditure of public money and private munificence than has been bestowed upon Antarctic research, we might now have been in possession of a continuous series of daily charts extending, not over thirty months, but over a hundred and twenty at least. Viewed from the standpoint which we have consistently occupied with regard to Antarctic investigation, this volume, fine as it is, is only a splendid fragment of the great work that might easily have been achieved.



## SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

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

(of the Argentine Meteorological Office).

(Third Article—continued).

RAINFALL AT MALDEN ISLAND AND MEAN TEMPERATURE  
AT PUNTA ARENAS FROM MAY TO AUGUST.

A RELATION can be traced between the amount of rain that falls at Malden Island,\* South Pacific (lat.  $3^{\circ} 59' S.$ , long.  $155^{\circ} W.$ ) during the period May to August, and the mean temperature at Punta Arenas\* (lat.  $53^{\circ} 10' S.$ , long.  $70^{\circ} 54' W.$ ) during the same months. When the rainfall at Malden Island is above the average the temperature at Punta Arenas is below the normal and *vice versa*. The Malden Island data are wanting in August, 1894, May, 1897, June, 1898, and August, 1903, so that in the following totals the *mean* rainfall has been entered for the four missing months.

RAINFALL, MALDEN ISLAND, AND MEAN TEMPERATURE, PUNTA ARENAS,  
MAY TO AUGUST.

|                      | 1890 | 1891 | 1892 | 1893 | 1894  | 1895 | 1896 | 1897   | 1898  | 1899 | 1900 |
|----------------------|------|------|------|------|-------|------|------|--------|-------|------|------|
| Rain. Malden I. .... | 2.8  | 3.5  | 6.7  | 4.2  | (9.1) | 2.0  | 6.4  | (15.2) | (4.5) | 10.7 | 16.0 |
| Temp. Punta Arenas.  | 37.5 | 36.6 | 37.7 | 38.6 | 38.0  | 38.0 | 38.6 | 35.4   | 38.1  | 36.3 | 34.2 |
|                      | 1901 | 1902 | 1903 | 1904 | 1905  | 1906 | 1907 | 1908   | 1909  | 1910 | 1911 |
| Rain. Malden I. .... | 2.2  | 15.3 | 7.1  | 7.8  | 33.3  | 9.4  | 6.8  | 1.6    | 6.7   | 2.5  | 4.2  |
| Temp. Punta Arenas.  | 37.8 | 35.5 | 37.2 | 35.6 | 33.8  | 33.6 | 35.6 | 36.1   | 34.3  | 36.3 | 37.5 |

Referring the above values to the normals for the whole period, viz. : 8.1 inches in the case of the Malden Island rainfall, and  $36^{\circ}.5$  for the mean temperature at Punta Arenas, we get the following departures for the years under consideration :—

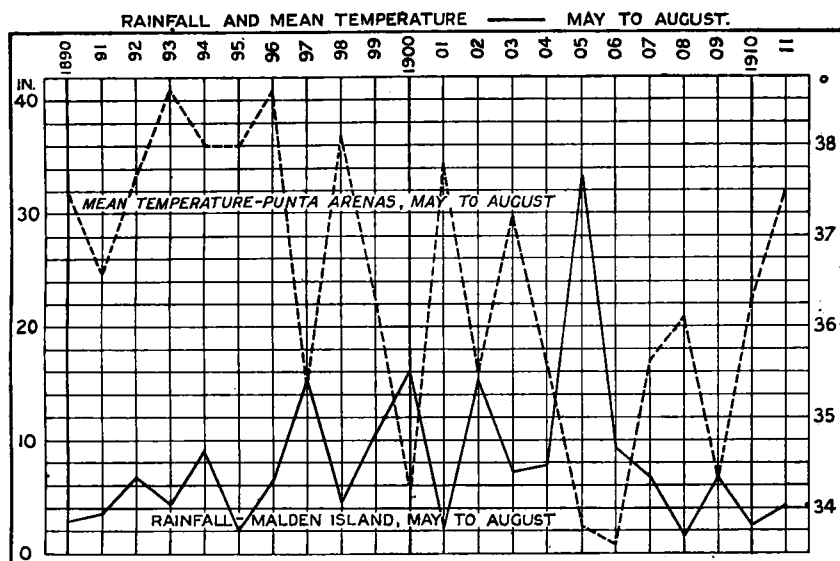
|                      | 1890 | 1891 | 1892 | 1893 | 1894  | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 |
|----------------------|------|------|------|------|-------|------|------|------|------|------|------|
| Rain. Malden I. .... | -5.3 | -4.6 | -1.4 | -3.9 | +1.0  | -6.1 | -1.3 | +7.1 | -3.6 | +2.6 | +7.9 |
| Temp. Punta Arenas   | +1.0 | +0.1 | +1.2 | +2.1 | +1.5  | +1.5 | +2.1 | -1.1 | +1.6 | -0.2 | -2.3 |
|                      | 1901 | 1902 | 1903 | 1904 | 1905  | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 |
| Rain. Malden I. .... | -5.9 | +7.2 | -1.0 | -0.3 | +25.2 | +1.3 | -1.3 | -4.5 | -1.3 | -5.6 | -3.9 |
| Temp. Punta Arenas   | +1.3 | -1.0 | +0.7 | -0.9 | -2.7  | -2.9 | -0.9 | -0.4 | -2.3 | -0.2 | +1.0 |

The correlation co-efficient deduced from the above data is 0.59, and the probable error 0.09.

During the first 17 years (1890-1906) there are only two years in which the signs are the same, viz., 1894 and 1904, but in each of the four years 1907-1910 a low mean temperature at Punta Arenas was associated with a deficient rainfall at Malden Island during the four months of the year under review. An examination of the data

\* Rain data for Malden Island kindly supplied by Dr. W. N. Shaw, temperature data for Punta Arenas until 1907 taken from Marabini's paper "*Observatorio Meteorologico del Edigio Salesiano 'S. Jose' en Punta Arenas de Magallanes.*" From 1908 to 1911 data are from this Observatory's Monthly Bulletins.

and diagrams given in Hildebrandsson's well-known papers shows occasional examples of an apparently well established correlation



breaking down for a few years, and the specific case under discussion offers yet another instance of the snapping of the chain.

An examination of the wind direction at Evangelist's Island (lat.  $52\frac{1}{2}^{\circ}$  S., long.  $75^{\circ}$  W.), at the Pacific entrance to the Straits of Magellan, and situated at no great distance from Punta Arenas, shows that in months or seasons characterised by excessive precipitation at Malden Island the winds in the south of the South Pacific blow from the south and south-west, but during dry months or seasons at Malden Island the prevailing winds at Evangelist Island are from the west and north-west. In other words, during wet months at Malden Island barometric pressure in the Antarctic regions south of Cape Horn is relatively high, and in dry years lower than usual, causing in the latter instance west and north-west winds to blow with increased frequency at Evangelist's Island. At the same time the South Pacific anti-cyclone is not only more intense but is lying further south than usual, and this, doubtless, causes some change in the position of the eastern margin of the equatorial South Pacific low pressure belt (see Isobaric Maps from May to August given in Dr. Buchan's *Challenger Report on Atmospheric Circulation*) so that rain-bearing winds at Malden Island blow with considerably diminished frequency. Hildebrandsson has shown that the variations of barometric pressure and rainfall between Tahiti and Tierra del Fuego are in opposite directions so that this opposition between the Malden Island rainfall and the temperature at Punta Arenas is probably brought about by the same physical processes induced by changes in the position of the South Pacific action centres.



## THE WEATHER OF JUNE.

THE month opened with fair or fine weather over the greater part of England, but it was generally unsettled and wet in Wales, Scotland and Ireland. Temperature was low on the 1st and 2nd, the shade minima ranging from  $34^{\circ}$  at Llangammarch Wells and  $35^{\circ}$  at West Linton to  $40^{\circ}$  in the south-east of England and west of Scotland, and  $44^{\circ}$  in the north of Scotland and at Jersey. No rain fell in London from the 9th to 19th, and at many stations in the south and south-east of England this period was also rainless. A marked rise in temperature took place on the 14th and 15th, and was maintained on the 16th and 17th, on which days the maximum temperature of the month was recorded at almost all stations. The readings ranged from  $87^{\circ}$  at Greenwich,  $85^{\circ}$  at Camden Square,  $84^{\circ}$  at Little Massingham, Cambridge and Wisley, to  $76^{\circ}$  at stations in the north and east of Scotland, and  $75^{\circ}$  in the north and south-west of Ireland. Local thunderstorms, mostly over the eastern counties of England, were frequent between the 17th and 20th. On the former date a severe storm burst over Cambridgeshire and Huntingdonshire, the rainfall exceeding 1.50 in. at many stations. At Stapleford House, where the thunder and lightning were exceptionally severe, 1.35 in. of rain fell in half-an-hour at about 3.30 p.m. At Great Paxton the fall was 2.90 in., of which 2.80 in. fell in an hour and a quarter, while at Brampton Grange 2.12 in. fell between 4.45 and 6 p.m. During the latter part of the month the rainfall was deficient, except in Ireland. Generally in the south-east of England and in the Thames Valley the rainfall was less than .10 in. during the last ten days. Temperature rose at the end of the month, and on the 29th the shade maxima reached  $80^{\circ}$  in London, Bournemouth and Brighton, and exceeded  $75^{\circ}$  at many stations in the south and east of England.

The total rainfall of the month was less than .50 in. in the estuary of the Thames and under 1.00 in. over the whole of the southern and western part of the Thames Valley except a small area round Basingstoke, where the total just exceeded an inch. The area with less than 1.00 in. of rain extended through the Midlands and along the east coast as far north as Yorkshire, excepting Cambridgeshire and the adjoining counties, where the heavy storm of the 17th raised the total to over 2.50 in. at a few stations. In Wales the fall varied from less than 2.00 in. along the eastern border to about 6.00 in. in the mountains of North Wales. Less than 2.00 in. fell along the east coast of Scotland, but more than 6.00 in. over a considerable area in Inverness and Ross. In Ireland the rain varied from about 1.50 in. in the south-east to about 3.00 in. over the interior, and about 5.00 in. in the extreme south-west. Taking the average June rainfall as 100, we find for England and Wales, 73; Scotland, 123; Ireland, 100; British Isles, 93.

Bright sunshine was abundant, many widely distant stations recording over 200 hours. In London there were no sunless days.

# THAMES VALLEY RAINFALL — JUNE, 1913.



ALTITUDE  
SCALE

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

SCALE OF MILES

0 5 10 15 20



## ROYAL METEOROLOGICAL SOCIETY.

AN ordinary afternoon meeting of the Society was held on June 18th, at 70, Victoria Street, S.W., Mr. C. J. P. Cave, President, in the chair.

A paper on "Pilot Balloon Observations in Barbados, 1910-1912," by Mr. J. S. Dines, was described by Mr. Marriott, and Mr. Cave gave some account of the circumstances and conditions of the observations which were carried out under considerable difficulty, and mostly by non-meteorologists. Deterioration of the rubber balloons precluded high ascents; the greatest altitude was just over 4 kilometres ( $2\frac{1}{2}$  miles). The records from 7 ascents were analysed by Mr. Dines. The few observations of vertical motion made, gave results very similar to those commonly found in England. The persistence of easterly wind suggests that the N.E. Trades are deflected in this region.

A paper by Mr. H. W. Braby on "The Harmattan Wind of the Guinea Coast" was read by the Secretary. The author examined data extending over a period of five years at Zungeru, Northern Nigeria, and brought to light many interesting facts in connection with the phenomenon. The most noteworthy feature was the small relative humidity on days of Harmattan. With regard to temperature, the period was too short for safe conclusions, but the data studied did not bear out the statement by Mr. Knox in his "Climate of Africa," that the Harmattan is a fresh wind in the morning, hot in the day, and cold at night.

Col. H. E. Rawson made some observations on the barometric conditions necessary for the Harmattan to prevail.

Dr. E. C. Snow read a paper on "The Correlation of Rainfall," written in collaboration with Mr. J. Peck. The data used, were those for the south-east of England, and were drawn from *British Rainfall*, 1908-1911. The authors correlated the monthly and seasonal falls of different periods. A significant feature of the results, was the persistence of low correlations for the summer months. An interesting discussion took place, and a critical examination by Mr. R. H. Hooker, of the method of treatment, suggested some doubt as to the accuracy of the conclusions.

Mr. C. Salter drew attention to the advisability of distinguishing between different types of rainfall in studying the figures, and suggested that some of the irregularities observed might thus be eliminated.

Col. H. E. Rawson spoke of the difference between monthly correlations in the northern and southern hemispheres. Whilst it was difficult to believe in any definite relation between the rainfall of the months in this country, the southern hemisphere provided many examples of well marked connection. He recommended the months of April and August for special investigation.

Mr. W. W. Bryant and Mr. D. W. Horner also took part in the discussion.

The following were elected fellows of the society:—Messrs. M. A. Bolton, B.A., G. F. Carter, A. S. Galbraith, W. E. Hall, Guy Harris, G. R. Swaine and W. A. Tinnock.

## Correspondence.

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

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## TEMPERATURE VAGARIES IN NEW YORK.

ON June 9th of the present year the minimum temperature reached 47°, which is the lowest for that date ever recorded. On the next night 49° was the minimum, which is a fraction above the lowest for that date. In the northern part of the State much damage by frost to fruit and vegetables was reported. These low temperatures were caused by an unusual and an extensive area of high pressure, with a reading of 30·60 in., crested in the vicinity of the Great Lakes.

January of this year had a total excess of over 300° above the normal, March about 200°, April 90°. The total excess to date since January 1st is over 600°.

C. DECKER.

*65, West 50th Street, New York, 10th June, 1913.*

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## ORIGIN OF THE SNOWDON GAUGE.

COL. WARD is not right in supposing his friend was the "inventor" of the Snowdon gauge. Writing far away from home, I cannot refer to Volume of *Symons's Meteorological Magazine* for 1883, but on page 23 it will be found that Mr. Symons gives the credit of it to Major Mathew; perhaps the Editor will give the details.

*Crescent Wharf, Birmingham, April 24th, 1913.* J. J. GILBERT.

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## REPORTED HEAVY RAINFALL.

ACCORDING to the *Morning Post*, on one night (I think the 29th) in May Tunbridge Wells had 3½ in. of rain in less than an hour. There seemed some additional evidence of a remarkable fall in the shape of accounts of floods, etc. There is, however, no indication of such a rainfall in your rainfall map for May. It would be interesting to know if it really happened.

Apropos of Mr. Bonacina's allusion in your Magazine to the heat of the sun and intensity of light on May 25th, I remember noticing the same thing. It was not very hot—at least as regards shade temperature—but our few brilliantly clear days do not generally appear to be also our hottest ones.

G. WESTON.

*The Vicarage, Bethersden, Ashford, Kent, 3rd July, 1913.*

[Unless authenticated by the name of the Observer and the place of observation, newspaper reports of remarkable falls of rain need not in our experience be taken too seriously. We understand that a very heavy fall of rain was recorded at Tunbridge Wells on

May 29th, but not as occurring in one hour. We are making enquiries as to the facts of the rainfall in question, but had not on previous occasions been able to induce the Observer who reports this fall to send us his readings for publication.—ED., *S.M.M.*]

### PARTIAL DROUGHT—HALO.

PARTIAL drought, since rainfall of .33 in. on May 29th, has now lasted 33 days, with a total fall of .31 in. in June on 9 days, including .11 in. on 6th, .06 in. on 9th, .04 in. on 5th. This broke to-day with .12 in. of rain.

In the City yesterday, at 3.15 p.m., there was an exceptionally perfect halo on an unusual type of high hazy cloud, which had developed between my entering the "Tube" at Shepherd's Bush and getting out at the Bank. This solar halo finally dissipated about 5.45 p.m., when the cloud material had become flocculent.

J. E. CLARK.

*Asgarth, Riddlesdown Road, Purley, Surrey, 2nd July, 1913.*

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### THE LATEST SNOW SPOT.

By J. R. GETHIN JONES.

REFERENCE has been made in this Magazine and in the newspapers for several years to the now famous snow gully known as *Y ffos ddyfn*, i.e., "the deep cut," situated about a quarter of a mile north-east of Carnedd Llewelyn, in Snowdonia, as the spot in South Britain where drifted snow remains longest into the summer.

On May 12th this spot was visited by Mr. D. H. Owen, of Birmingham, in company with the writer, with the object of ascertaining the comparative extent and form of the drift, compared with those of previous years at Whitsun-tide. The size and position of the gully are unique, not only for the accumulation of snow from all points except S.E., forming a good index of the character of a past winter, but in addition to this the lie and form of the drift tell a story of past snow storms, as fully described in the *British Rainfall*, 1909.

We started from Llanrwst at 9 a.m. with the temperature at 53°, the barometer falling, and a light S.E. wind and rain which intercepted the Berwyn and Snowdon ranges. After reaching the first divide at an altitude of 1,300 ft., above Trefriw, we could see the interesting effect of the first rise, on the Berwyn Range, of the moisture from the S.E., after crossing the English plains, in the formation of cloud, and its disappearance after crossing these ranges.

During the ascent over the Berwyn Range a new layer of cloud or mist was formed, with a darker sky, but during the descent and whilst passing over the intermediate lower ground lying about 25 miles east of the Snowdonia Range, the cloud of the lower



strata disappeared, disclosing a light and high nimbus cloud from which rain was falling. On the ascent of the second range we encountered the same cloud formation at 2,500 feet, one mile east of Carned Llewelyn, with rain falling much more heavily than at Llanrwst. This was due to the high mountain condensation and not to any change in the weather, as was shown by the relative rainfall measurements for the day, the ratio between the high and low level stations being as much as ten to one. This we often experience during a light valley rain.

The first snow drifts were met at 2,700 feet, and the object of our long walk was reached at 3,000 feet in a cold mist and rain, with a temperature of 40° and a high wind.

The gully, which lies S.E. to N.W. for a length of 450 feet, was found nearly full on the S.W. side only for a length of about 300 feet. The greatest width was about 50 feet, and the estimated depth of snow 20 feet. The deposit was formed of quite hard and clean snow. An examination of the extent, lie and shape of the drift told us the following story about the past winter.

1. That the snow storms of the winter of 1912-13, which drifted there from all points except S.E., were not sufficient to fill the gully, as in the winter of 1909-10.

2. No drifts, except perhaps small ones since melted, had occurred from the N.E. quarter.

3. No signs of any deposit of Lancashire soot which generally comes with the Easter snow from that direction, darkening the snow bed and leaving a soot deposit at the end of the melting.

4. The lie and form of the bed showed clearly that it was the effect of S.W. and W. drifting, being from the smallest drifting lines, and it was very clean. It had apparently collected simultaneously with the heavy and cold rain and sleet experienced below 2,000 feet in March. If the snow had drifted from the N.W., N., N.E., and E. points, being the longest drifting lines, I believe that the gully would have been easily filled. As the sleet and cold rain in the valleys during that month measured from six to ten inches the equivalent at Carnedd Llewelyn would be as many feet of dry snow.

5. With average weather it was estimated at the time that this drift of 1912-13 would last another month, say the middle of June, compared with the following in previous years. As a matter of fact the drift lasted till the end of the first week of June.

1908-9. Gully partly filled. The drift disappeared in the last week of June.

1909-10. Gully filled. The drift disappeared in the middle of July (see photographs in *British Rainfall*, 1909).

1910-11. Gully partly filled. The drift disappeared before the end of May.

1911-12. Gully partly filled. The drift disappeared in the last week of May.

Some 30 years ago it lasted until the middle of August during the harvest.

## INTERNATIONAL BALLOON ASCENTS.

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

*October 5th, 1910.*

| Starting Point.   | Country.     | A<br>miles. | B<br>° F. | C<br>miles | D<br>° F. | E<br>miles. | F          |
|-------------------|--------------|-------------|-----------|------------|-----------|-------------|------------|
| Pyrton Hill* .... | England ...  | 8·2         | —87       | 9·4        | —86       | 33          | S.W.       |
| " .....           | " ..         | 8·2         | —89       | 10·6       | —83       | 27          | S. by W.   |
| Brussels .....    | Belgium ...  | —           | —         | 7·1        | —65       | 44          | S.W.       |
| Hamburg .....     | Germany ..   | 9·2         | —80       | 16·9       | —54?      | 60          | S.         |
| Lindenberg ....   | " ..         | 8·1         | —80       | 11·7       | —68       | 54          | S.W. by S. |
| Paris .....       | France ....  | 8·0         | —78       | 9·4        | —69       | 110         | S.W. by W. |
| Strassburg .....  | Germany ..   | 8·6         | —78       | 9·3        | —76       | 68          | S.W.       |
| Munich .....      | " ..         | 7·6         | —71       | 7·6        | —71       | 94          | S.W.       |
| Vienna .....      | Austria .... | —           | †         | 9·1        | —67       | 122         | W.S.W.     |
| Puy de Dome ..    | France ....  | 6·6         | —81       | 7·6        | —74       | 187         | S.W.       |
| Pavia .....       | Italy .....  | 7·8         | —69       | 11·0       | —63       | 151         | S.W.       |
| Pavlovsk .....    | Russia ....  | 7·4         | —67       | 10·1       | —54       | 71          | E.S.E.     |
| Nizhni Olchedaëff | " .....      | 7·7         | —69       | 10·3       | —62       | 32          | S.W. by 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.

\* 4.40 p.m., October 5th.

† To indefinite to be determined.

On the 5th a shallow depression lay over the Mediterranean, a very deep one to the north-east of Iceland, while an anticyclone (30·60 in.) was found to the south-west of England. On the 6th the anticyclone was over Ireland, while both depressions had moved to the eastward.

The heights in column A are unusually large, the value 9·2 miles (14·7 km.) being especially noticeable at Hamburg.

The general drift of the balloons to the south-west is also unusual, but, so far as my experience goes, there is connection between the two anomalies.

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METEOROLOGICAL NEWS AND NOTES.

MR. R. T. OMOND, for so many years the superintendent of Ben Nevis Observatory has, we are happy to observe, received the honorary degree of LL.D. from the University of Edinburgh. No honour was ever better deserved.

BRITISH RAINFALL, 1912, is now approaching completion, and a large part of it is printed off, but there is still time to include any returns in the General Table of total rainfall which may reach us within a week of the publication of this Magazine.

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*Erratum.*—In June number, p. 88, insert in Table,  
1901 ... 29th 83°·8



## RAINFALL TABLE FOR JUNE, 1913.

| 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. | 1913.<br>in. |
| Camden Square.....                   | <i>London</i> .....          | 51 32      | 0 8                  | 111                            | 2'28                           | '58          |
| Tenterden.....                       | <i>Kent</i> .....            | 51 4       | *0 41                | 190                            | 2'03                           | '53          |
| Arundel (Patching).....              | <i>Sussex</i> .....          | 50 51      | 0 27                 | 130                            | 2'13                           | 1'34         |
| Fawley (Cadland).....                | <i>Hampshire</i> .....       | 50 50      | 1 22                 | 52                             | 2'17                           | '84          |
| Oxford (Magdalen College).....       | <i>Oxfordshire</i> .....     | 51 45      | 1 15                 | 186                            | 2'27                           | '46          |
| Wellingborough (Croyland Abbey)..... | <i>Northampton</i> .....     | 52 18      | 0 41                 | 174                            | 2'10                           | '65          |
| Shoburness.....                      | <i>Essex</i> .....           | 51 31      | *0 48                | 13                             | 1'77                           | '17          |
| Bury St. Edmunds (Westley).....      | <i>Suffolk</i> .....         | 52 15      | *0 40                | 226                            | 2'21                           | 1'33         |
| Geldeston [Beccles].....             | <i>Norfolk</i> .....         | 52 27      | *1 31                | 38                             | 1'77                           | '81          |
| Polapit Tamar [Launceston].....      | <i>Devon</i> .....           | 50 40      | 4 22                 | 315                            | 2'18                           | 1'55         |
| Rousdon [Lynne Regis].....           | „.....                       | 50 41      | 3 0                  | 516                            | 2'18                           | '76          |
| Stroud (Uplfield).....               | <i>Gloucestershire</i> ..... | 51 44      | 2 13                 | 226                            | 2'43                           | '70          |
| Church Stretton (Wolstaston).....    | <i>Shropshire</i> .....      | 52 35      | 2 48                 | 800                            | 2'59                           | 1'41         |
| Coventry (Kingswood).....            | <i>Warwickshire</i> .....    | 52 24      | 1 30                 | 340                            | 2'52                           | '77          |
| Boston.....                          | <i>Lincolnshire</i> .....    | 52 58      | 0 1                  | 11                             | 1'95                           | 1'02         |
| Worksop (Hodsock Priory).....        | <i>Nottinghamshire</i> ..... | 53 22      | 1 5                  | 56                             | 2'06                           | '60          |
| Macclesfield.....                    | <i>Cheshire</i> .....        | 53 15      | 2 7                  | 501                            | 2'85                           | 2'71         |
| Southport (Hesketh Park).....        | <i>Lancashire</i> .....      | 53 38      | 2 59                 | 38                             | 2'26                           | 2'10         |
| Arncliffe Vicarage.....              | <i>Yorkshire, W.R.</i> ..... | 54 8       | 2 6                  | 732                            | 3'63                           | 2'69         |
| Wetherby (Ribston Hall).....         | „.....                       | 53 59      | 1 24                 | 130                            | 2'17                           | 1'41         |
| Hull (Pearson Park).....             | „ <i>E.R.</i> .....          | 53 45      | 0 20                 | 6                              | 2'09                           | '84          |
| Newcastle (Town Moor).....           | <i>Northumberland</i> .....  | 54 59      | 1 38                 | 201                            | 2'04                           | 1'41         |
| Borrowdale (Seathwaite).....         | <i>Cumberland</i> .....      | 54 30      | 3 10                 | 423                            | 6'94                           | 11'83        |
| Cardiff (Ely).....                   | <i>Glamorgan</i> .....       | 51 29      | 3 13                 | 53                             | 2'55                           | 2'14         |
| Haverfordwest.....                   | <i>Pembroke</i> .....        | 51 48      | 4 58                 | 90                             | 2'74                           | 2'45         |
| Aberystwyth (Gogerddan).....         | <i>Cardigan</i> .....        | 52 26      | 4 1                  | 83                             | 2'97                           | 5'33         |
| Llandudno.....                       | <i>Carnarvon</i> .....       | 53 20      | 3 50                 | 72                             | 1'97                           | 2'63         |
| Cargen [Dumfries].....               | <i>Kirkcudbright</i> .....   | 55 2       | 3 37                 | 80                             | 2'84                           | 3'16         |
| Marchmont House.....                 | <i>Berwick</i> .....         | 55 44      | 2 24                 | 498                            | 2'38                           | 2'80         |
| Girvan (Pinnore).....                | <i>Ayr</i> .....             | 55 10      | 4 49                 | 207                            | 3'04                           | 2'91         |
| Glasgow (Queen's Park).....          | <i>Renfrew</i> .....         | 55 53      | 4 18                 | 144                            | 2'41                           | 3'50         |
| Inveraray (Newtown).....             | <i>Argyll</i> .....          | 56 14      | 5 4                  | 17                             | 3'64                           | 5'53         |
| Mull (Quinish).....                  | „.....                       | 56 34      | 6 13                 | 35                             | 3'30                           | 2'80         |
| Dundee (Eastern Necropolis).....     | <i>Forfar</i> .....          | 56 28      | 2 57                 | 199                            | 2'06                           | 1'27         |
| Braemar.....                         | <i>Aberdeen</i> .....        | 57 0       | 3 24                 | 1114                           | 2'18                           | 1'61         |
| Aberdeen (Cranford).....             | „.....                       | 57 8       | 2 7                  | 120                            | 2'02                           | 1'35         |
| Cawdor.....                          | <i>Nairn</i> .....           | 57 31      | 3 57                 | 250                            | 2'13                           | 2'93         |
| Fort Augustus (S. Benedict's).....   | <i>E. Inverness</i> .....    | 57 9       | 4 41                 | 68                             | 2'07                           | 3'72         |
| Loch Torridon (Bendamph).....        | <i>W. Ross</i> .....         | 57 32      | 5 32                 | 20                             | 4'07                           | 7'47         |
| Dunrobin Castle.....                 | <i>Sutherland</i> .....      | 57 59      | 3 56                 | 14                             | 2'10                           | 3'20         |
| Wick.....                            | <i>Caithness</i> .....       | 58 26      | 3 6                  | 77                             | 1'83                           | 2'04         |
| Killarney (District Asylum).....     | <i>Kerry</i> .....           | 52 4       | 9 31                 | 178                            | 2'92                           | 3'45         |
| Waterford (Brook Lodge).....         | <i>Waterford</i> .....       | 52 15      | 7 7                  | 104                            | 2'79                           | 2'19         |
| Nenagh (Castle Lough).....           | <i>Tipperary</i> .....       | 52 54      | 8 24                 | 120                            | 2'70                           | 3'35         |
| Ennistymon House.....                | <i>Clare</i> .....           | 52 57      | 9 18                 | 37                             | 3'18                           | 3'61         |
| Gorey (Courtown House).....          | <i>Wexford</i> .....         | 52 40      | 6 13                 | 80                             | 2'59                           | 1'34         |
| Abbey Leix (Blandsfort).....         | <i>Queen's County</i> .....  | 52 56      | 7 17                 | 532                            | 2'58                           | 3'22         |
| Dublin (Fitz William Square).....    | <i>Dublin</i> .....          | 53 21      | 6 14                 | 54                             | 2'00                           | 1'20         |
| Mullingar (Belvedere).....           | <i>Westmeath</i> .....       | 53 29      | 7 22                 | 367                            | 2'72                           | 3'02         |
| Crossmolina (Enniscooe).....         | <i>Mayo</i> .....            | 54 4       | 9 16                 | 74                             | 3'17                           | 3'55         |
| Cong (The Glebe).....                | „.....                       | 53 33      | 9 16                 | 112                            | 3'18                           | 4'04         |
| Collooney (Markree Obsy.).....       | <i>Sligo</i> .....           | 54 11      | 8 27                 | 127                            | 3'11                           | 3'21         |
| Seaforde.....                        | <i>Down</i> .....            | 54 19      | 5 50                 | 180                            | 2'88                           | 1'75         |
| Bushmills (Dundarave).....           | <i>Antrim</i> .....          | 55 12      | 6 30                 | 162                            | 2'56                           | 2'02         |
| Omagh (Edenfel).....                 | <i>Tyrone</i> .....          | 54 36      | 7 18                 | 280                            | 2'82                           | 3'27         |

## RAINFALL TABLE FOR JUNE, 1913—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.      | 1913. | Diff. from Aver. in. | % of Av. |                        |                 |
|                          |          | in.               | Date.       |    | in.                   | in.   |                      |          | in.                    |                 |
| -1.70                    | 25       | .19               | 8           | 7  | 10.96                 | 10.67 | - .29                | 97       | 25.11                  | Camden Square   |
| -1.50                    | 26       | .12               | 19          | 10 | 11.44                 | 12.42 | + .98                | 109      | 27.64                  | Tenterden       |
| - .79                    | 63       | .54               | 20          | 8  | 12.46                 | 17.32 | +4.86                | 139      | 30.48                  | Patching        |
| -1.33                    | 39       | .25               | 17          | 12 | 13.31                 | 16.63 | +3.32                | 125      | 31.87                  | Cadland         |
| -1.81                    | 20       | .11               | 8           | 9  | 10.60                 | 11.39 | + .79                | 107      | 24.58                  | Oxford          |
| -1.45                    | 31       | .22               | 6           | 10 | 11.14                 | 11.62 | + .48                | 104      | 25.17                  | Croyland Abbey  |
| -1.60                    | 10       | .05               | 6           | 7  | 8.00                  | 7.96  | - .04                | 99       | 19.28                  | Shoeburyness    |
| - .88                    | 60       | .46               | 17          | 9  | 10.76                 | 11.07 | + .31                | 103      | 25.40                  | Westley         |
| - .96                    | 46       | .28               | 9           | 11 | 9.61                  | 9.33  | - .28                | 97       | 23.73                  | Geldeston       |
| - .63                    | 71       | .61               | 5           | 13 | 15.88                 | 23.98 | +8.10                | 151      | 38.27                  | Polapit Tamar   |
| -1.42                    | 35       | .23               | 19          | 13 | 14.33                 | 17.46 | +3.13                | 122      | 33.54                  | Rousdon         |
| -1.73                    | 29       | .16               | 5           | 10 | 13.08                 | 16.87 | +3.79                | 129      | 29.81                  | Stroud          |
| -1.18                    | 54       | .44               | 9           | 11 | 14.30                 | 21.41 | +7.11                | 150      | 32.41                  | Wolstaston      |
| -1.75                    | 30       | .24               | 9           | 9  | 12.75                 | 16.05 | +3.30                | 126      | 28.08                  | Coventry        |
| - .93                    | 52       | .39               | 6           | 11 | 9.86                  | 10.78 | + .92                | 109      | 23.35                  | Boston          |
| -1.46                    | 29       | .20               | 5           | 13 | 10.80                 | 11.13 | + .33                | 103      | 24.46                  | Hodsock Priory  |
| - .14                    | 95       | .70               | 9           | 17 | 14.76                 | 18.59 | +3.83                | 126      | 34.73                  | Macclesfield    |
| - .16                    | 93       | .51               | 7           | 15 | 12.96                 | 15.77 | +2.81                | 122      | 32.70                  | Southport       |
| - .94                    | 74       | 1.20              | 9           | 14 | 27.22                 | 36.21 | +8.99                | 133      | 61.49                  | Arnccliffe      |
| - .76                    | 65       | .30               | 18          | 10 | 11.63                 | 12.04 | + .41                | 104      | 26.87                  | Ribston Hall    |
| -1.25                    | 40       | .25               | 24          | 11 | 11.08                 | 11.69 | + .61                | 105      | 26.42                  | Hull            |
| - .63                    | 69       | .50               | 24          | 11 | 11.55                 | 14.48 | +2.93                | 125      | 27.94                  | Newcastle       |
| +4.89                    | 170      | 4.20              | 9           | 18 | 56.38                 | 75.55 | +19.17               | 134      | 129.48                 | Seathwaite      |
| - .41                    | 84       | .51               | 9           | 13 | 17.22                 | 25.93 | +8.71                | 150      | 42.28                  | Cardiff         |
| - .29                    | 89       | .47               | 7           | 9  | 19.45                 | 27.90 | +8.45                | 143      | 46.81                  | Haverfordwest   |
| +2.36                    | 180      | 2.10              | 9           | 17 | 18.12                 | 31.20 | +13.08               | 172      | 45.46                  | Gogerdan        |
| + .66                    | 133      | .64               | 19          | 12 | 12.37                 | 16.09 | +3.72                | 130      | 30.36                  | Llandudno       |
| + .32                    | 111      | .76               | 2           | 15 | 19.06                 | 29.04 | +9.98                | 152      | 43.47                  | Cargen          |
| + .42                    | 118      | .96               | 19          | 10 | 14.38                 | 15.41 | +1.03                | 107      | 33.76                  | Marchmont       |
| - .13                    | 96       | .68               | 9           | 20 | 21.10                 | 24.45 | +3.35                | 116      | 49.77                  | Girvan          |
| +1.09                    | 145      | .94               | 19          | 17 | 15.51                 | 19.98 | +4.47                | 129      | 35.97                  | Glasgow         |
| +1.89                    | 152      | 1.91              | 9           | 20 | 29.32                 | 37.78 | +8.46                | 129      | 68.67                  | Inveraray       |
| - .50                    | 85       | .61               | 9           | 19 | 23.55                 | 29.08 | +5.53                | 123      | 56.57                  | Quinish         |
| - .79                    | 62       | .31               | 4           | 12 | 12.02                 | 14.45 | +2.43                | 120      | 28.64                  | Dundee          |
| - .57                    | 74       | .25               | 4           | 14 | 15.15                 | 20.66 | +5.51                | 136      | 34.93                  | Braemar         |
| - .67                    | 67       | .35               | 4           | 12 | 14.02                 | 15.70 | +1.68                | 112      | 32.73                  | Aberdeen        |
| + .80                    | 138      | .76               | 18          | 13 | 12.51                 | 11.26 | -1.25                | 90       | 29.33                  | Cawdor          |
| +1.65                    | 180      | .99               | 9           | 16 | 20.22                 | 24.48 | +4.26                | 121      | 44.53                  | Fort Augustus   |
| +3.40                    | 183      | 1.37              | 9           | 22 | 37.55                 | 44.47 | +6.92                | 118      | 83.93                  | Bendamph        |
| +1.10                    | 152      | .45               | 4, 18       | 16 | 14.28                 | 11.62 | -2.66                | 81       | 31.90                  | Dunrobin Castle |
| + .21                    | 111      | .37               | 4           | 16 | 12.71                 | 10.81 | -1.90                | 85       | 29.88                  | Wick            |
| + .53                    | 118      | .71               | 9           | 17 | 24.87                 | 32.31 | +7.44                | 130      | 54.81                  | Killarney       |
| - .60                    | 79       | .39               | 18          | 11 | 17.40                 | 24.10 | +6.70                | 138      | 39.57                  | Waterford       |
| + .65                    | 124      | .95               | 9           | 15 | 17.51                 | 25.13 | +7.62                | 144      | 39.43                  | Castle Lough    |
| + .43                    | 114      | .72               | 9           | 19 | 19.67                 | 26.12 | +6.45                | 133      | 46.52                  | Ennistymon      |
| -1.25                    | 52       | .29               | 18          | 11 | 15.42                 | 19.65 | +4.23                | 127      | 34.99                  | Courtown Ho.    |
| + .64                    | 125      | .80               | 5           | 14 | 15.84                 | 23.85 | +8.01                | 150      | 35.92                  | Abbey Leix      |
| - .80                    | 60       | .25               | 19          | 13 | 12.15                 | 15.10 | +2.95                | 124      | 27.68                  | Dublin          |
| + .30                    | 111      | .72               | 18          | 16 | 16.01                 | 22.59 | +6.58                | 141      | 36.15                  | Mullingar       |
| + .38                    | 112      | .63               | 9           | 18 | 23.38                 | 33.07 | +9.69                | 141      | 52.87                  | Enniscoe        |
| + .86                    | 127      | .88               | 9           | 18 | 21.41                 | 31.13 | +9.72                | 145      | 48.90                  | Cong            |
| + .10                    | 103      | .66               | 18          | 17 | 18.83                 | 25.89 | +7.06                | 137      | 42.71                  | Markree         |
| -1.13                    | 61       | .46               | 12          | 14 | 17.42                 | 20.31 | +2.89                | 117      | 38.91                  | Seaforde        |
| - .54                    | 79       | .58               | 19          | 14 | 15.49                 | 15.09 | - .40                | 97       | 37.56                  | Dundarave       |
| + .45                    | 116      | .66               | 9           | 16 | 17.10                 | 23.07 | +5.97                | 135      | 39.38                  | Omagh           |

## SUPPLEMENTARY RAINFALL, JUNE, 1913.

| Div.  | STATION.                      | Rain<br>inches | Div.   | STATION.                      | Rain<br>inches. |
|-------|-------------------------------|----------------|--------|-------------------------------|-----------------|
| II.   | Warlingham, Redvers Road..    | ·40            | XI.    | Lligwy .....                  | 2·76            |
| „     | Ramsgate .....                | ·89            | „      | Douglas .....                 | ...             |
| „     | Hailsham .....                | 1·12           | XII.   | Stoneykirk, Ardwell House...  | 1·75            |
| „     | Totland Bay, Aston House...   | ·61            | „      | Dalry, The Old Garroch.....   | 4·41            |
| „     | Stockbridge, Ashley..         | ·33            | „      | Beattock, Kinnelhead .....    | 3·57            |
| „     | Grayshott .....               | ·47            | „      | Langholm, Drove Road .....    | 2·93            |
| „     | Caversham, Rectory Road ...   | ·49            | XIII.  | Meggat Water, Cramilt Lodge   | 3·35            |
| III.  | Harrow Weald, Hill House...   | ·42            | „      | North Berwick Reservoir.....  | 1·13            |
| „     | Pitsford, Sedgebrook.....     | 1·19           | „      | Edinburgh, Royal Observaty..  | 1·49            |
| „     | Woburn, Milton Bryant.....    | 1·16           | XIV.   | Maybole, Knockdon Farm ...    | 2·48            |
| „     | Chatteris, The Priory.....    | 1·19           | XV.    | Ballachulish House .....      | 6·07            |
| IV.   | Colchester, Hill Ho., Lexden  | 1·07           | „      | Campbeltown, Witchburn ..     | 2·77            |
| „     | Newport, Belmont House ...    | 1·42           | „      | Holy Loch, Ardnadam.....      | 7·29            |
| „     | Ipswich, Rookwood, Copdock    | 1·57           | „      | Islay, Eallabus .....         | 2·91            |
| „     | Blakeney.....                 | ·98            | „      | Tiree, Cornaigmore .....      | 2·55            |
| „     | Swaffham .....                | 1·09           | XVI.   | Dollar Academy .....          | 2·47            |
| V.    | Bishops Cannings .....        | ·72            | „      | Balquhiddier, Stronvar.....   | 5·21            |
| „     | Winterbourne Steepleton.....  | ...            | „      | Glenlyon, Meggernie Castle..  | 4·86            |
| „     | Ashburton, Druid House.....   | 1·08           | „      | Blair Atholl .....            | 1·72            |
| „     | Cullompton .....              | ·89            | „      | Coupar Angus .....            | 2·24            |
| „     | Lynmouth, Rock House .. ...   | 1·75           | „      | Montrose, Sunnyside Asylum.   | 2·07            |
| „     | Okehampton, Oaklands.....     | 2·22           | XVII.  | Alford, Lynturk Manse .....   | 2·38            |
| „     | Hartland Abbey.....           | 1·62           | „      | Fyvie Castle .....            | 2·76            |
| „     | Probus, Lamellyn.....         | 1·31           | „      | Keith Station ..              | 2·11            |
| „     | North Cadbury Rectory.....    | 1·35           | XVIII. | Alvey Manse.....              | 2·55            |
| VI.   | Clifton, Pembroke Road.....   | 1·07           | „      | Loch Quoich, Loan .....       | 13·60           |
| „     | Ross, The Graig .....         | ·77            | „      | Drumnadrochit .....           | 3·52            |
| „     | Shifnal, Hatton Grange.....   | ·96            | „      | Skye, Dunvegan .....          | 5·06            |
| „     | Droitwich.....                | ·82            | „      | N. Uist, Lochmaddy .....      | ...             |
| „     | Blockley, Upton Wold.....     | ·49            | „      | Glencarron Lodge .....        | 8·68            |
| VII.  | Market Overton.....           | 1·26           | XIX.   | Invershin .....               | 2·85            |
| „     | Market Rasen .....            | ·67            | „      | Melvich .....                 | 1·89            |
| „     | Bawtry, Hesley Hall .....     | ·85            | „      | Loch Stack, Ardchullin .....  | 5·79            |
| „     | Derby, Midland Railway.....   | 1·15           | XX.    | Skibbereen Rectory .....      | 4·64            |
| „     | Buxton .....                  | 3·24           | „      | Dunmanway, The Rectory ..     | 4·16            |
| VIII. | Nantwich, Dorfold Hall .....  | 1·46           | „      | Glanmire, Lota Lodge, No. 1   | 2·23            |
| „     | Chatburn, Middlewood .....    | 2·91           | „      | Mitchelstown Castle.....      | 2·83            |
| „     | Cartmel, Flookburgh .....     | 2·52           | „      | Darrynane Abbey.....          | 4·40            |
| IX.   | Langsett Moor, Up. Midhope    | 1·40           | „      | Clonmel, Bruce Villa .....    | 2·19            |
| „     | Scarborough, Scalby .....     | 1·38           | „      | Newmarket-on-Fergus, Fenloe   | 3·96            |
| „     | Ingleby Greenhow .....        | 1·63           | XXI.   | Laragh, Glendalough .....     | 1·70            |
| „     | Mickleton .....               | 1·80           | „      | Ballycumber, Moorock Lodge    | 2·88            |
| X.    | Bellingham, High Green Manor  | 1·72           | „      | Balbriggan, Ardgillan .....   | 1·29            |
| „     | Ilderton, Lilburn Cottage ... | 1·62           | XXII.  | Woodlawn .....                | 3·97            |
| „     | Keswick, The Bank.....        | 3·52           | „      | Westport, St. Helens ...      | 2·43            |
| XI.   | Llanfarcha Grange .....       | 1·32           | „      | Dugort, Slievemore Hotel ...  | 4·52            |
| „     | Treherbert, Tyn-y-waun .....  | 5·16           | „      | Mohill Rectory ..             | 3·25            |
| „     | Carmarthen, The Friary .....  | 2·57           | XXIII. | Enniskillen, Portora.....     | 3·93            |
| „     | Castle Malgwyn [Llechryd]...  | 2·14           | „      | Dartrey [Cootehill] .....     | 3·59            |
| „     | Crickhowell, Tal-y-maes ..... | 1·80           | „      | Warrenpoint, Manor House ..   | ...             |
| „     | New Radnor, Ednol .....       | 2·35           | „      | Banbridge, Milltown .....     | 3·08            |
| „     | Birmingham WW., Tyrmynydd     | 3·51           | „      | Belfast, Cave Hill Road ..... | 2·67            |
| „     | Lake Vyrnwy .....             | 3·69           | „      | Glenarm Castle.....           | 2·17            |
| „     | Llangyhanfal, Plâs Draw.....  | 1·75           | „      | Londonderry, Creggan Res...   | 3·31            |
| „     | Dolgelly, Bryntirion.....     | 5·41           | „      | Dunfanaghy, Horn Head ...     | 3·16            |
| „     | Bettws-y-Coed, Tyn-y-bryn...  | 3·78           | „      | Killybegs .....               | 4·21            |

## METEOROLOGICAL NOTES ON JUNE, 1913.

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.—Only twice in the previous 55 years has June been drier, viz., in 1877 and 1895, when the total R was 42 in. and 30 in. respectively. Duration of sunshine 199·8\* hours, and no sunless days. Duration of R only 6·1 hours, and the least recorded in June in 33 years. Mean temp. 61°·1 or 1°·0 above the average. Evaporation 3·13 in. Shade max. 85°·4 on 17th; min. 43°·6 on 9th. F 0, f 0.

TENTERDEN.—Duration of sunshine 218·0† hours. Only 8 days with shade temp. over 70°. Shade max. 83°·0 on 17th; min. 42°·0 on 9th. F 0, f 0.

TOTLAND BAY.—Duration of sunshine 218·7\* hours, and 15·0 hours on 29th. Shade max. 77°·8 on 16th; min. 44°·1 on 1st. F 0, f 0.

MILTON BRYAN.—Fine and drying month with a good deal of cloud or haze, and some days of very bright sunshine. Heavy local TS on 17th, with torrential R at Loddington, Dunstable and Luton. Shade max. 87°·0 on 16th and 17th; min. 35°·0 on 3rd.

IPSWICH, COPDOCK.—A few fine warm days in the middle, otherwise inclined to be dull and disappointing. Agriculture in a very good state as a whole. Duration of sunshine 203·1\* hours. Mean temp. 58°·2. Shade max. 86°·0 on 17th; min. 41°·0 on 13th. F 0, f 1.

NORTH CADBURY.—A month of very welcome dryness. Fairly quiet with wind about normal. A good hay crop is being rapidly got in in good condition. Shade max. 84°·0 on 30th; min. 40°·5 on 9th. F 0, f 0.

WOOLSTASTON.—Fine on the whole and very dry after the 11th. The hay crop is good and is being harvested early. Shade max. 74°·0 on 16th; min. 44°·0 on 1st and 9th.

HODSOCK PRIORY.—Shade max. 80°·0 on 16th; min. 40°·1 on 1st. F 0, f 0.

SOUTHPORT.—Duration of sunshine 184·2\* hours or 34·0 hours below the average. Duration of R 40·2 hours. Mean temp. 56°·5. Evaporation 3·03 in. Shade max. 76°·0 on 16th; min. 44°·0 on 1st and 2nd. F 0, f 0.

HULL.—Very dry periods with frequent squally dry winds. Duration of sunshine 128·5\* hours. Shade max. 77°·0 on 18th; min. 42°·0 on 15th. F 0, f 0.

HAVERFORDWEST.—Fine, dry and cold, with gales on three days. Duration of sunshine 229·9\* hours. Shade max. 75°·7 on 16th; min. 37°·6 on 1st. F 0, f 0.

BETTS-Y-COED.—Fine and dry on the whole, practically all the R having fallen in the first 8 days and 2·35 in. on one day, the 8th.

MARCHMONT.—Duration of sunshine 192·9 hours on 29 days. Shade max. 72°·0 on 16th; min. 38°·0 on 12th. F 0, f 0.

EDINBURGH.—Shade max. 70°·4 on 29th; min. 41°·2 on 12th. F 0, f 0.

INVERARAY.—A great number of the fine days were chilly and sunless, and, except the 16th, none were really hot. Heavy R on 8th and 9th is believed to have done much hurt to young grouse.

ABERDEEN.—Strong gale from 6th to 10th did much damage to plants and trees.

DRUMNADROCHIT.—R 1·29 in. and rain days 2 above the average. Violent TS occurred on 18th and 24th.

LOCH STACK.—Duration of sunshine 130·5\* hours.

DUNMANWAY.—First 11 days were unsettled and cold. In the rest of the month there was little R except on the nights of 17th, 20th and 22nd. Cold month on the whole, but 15th, 16th and last four days were very warm.

DUBLIN.—Brisk W. and N.W. winds and much cloud. The last few days were very fine, warm and brilliant. Mean temp. 57°·1 or 0°·8 below the average. Shade max. 75°·1 on 17th; min. 43°·4 on 12th. F 0, f 0.

OMAGH, EDENFEL.—A fine spell from 13th to 17th and also for last four days; the remainder was cold and wet. All vegetation backward.

\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, January, 1913.

| 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.  |          |      |               |           |                 |                   |            |       |       |
|                                                                  |           |       |          |        |          |      |               | 0-100     |                 |                   |            |       |       |
| London, Camden Square                                            | 52°3      | 23    | 27°3     | 13     | 46°0     | 36°3 | 38°8          | 91        | 73°3            | 23°0              | 2°57       | 17    | 7·5   |
| Malta ... ..                                                     | 63·1      | 30    | 48·2     | 20     | 59·7     | 52·8 | ...           | 86        | 127·0           | ..                | 2·55       | 12    | 5·3   |
| Lagos ... ..                                                     | 91·5      | 15    | 72·0     | 2, 20  | 89·4     | 75·2 | 73·6          | 73*       | 160·2           | 69·0              | ·00        | 0     | 4·5   |
| Cape Town ... ..                                                 | 101·7     | 14    | 55·3     | 4      | 82·7     | 63·2 | 58·7          | 63        | ...             | ...               | ·38        | 3     | 3·2   |
| Natal, Durban ... ..                                             | 84·0      | 19    | 62·6     | 3      | 78·9     | 68·5 | 69·4          | 81        | ...             | ...               | 6·83       | 12    | 4·3   |
| Johannesburg ... ..                                              | 82·6      | 19    | 47·4     | 3      | 76·3     | 55·9 | 54·9          | 72        | 154·4           | 47·0              | 2·66       | 18    | 3·6   |
| Mauritius ... ..                                                 | 86·2      | 25    | 68·1     | 4      | 82·7     | 72·0 | 70·3          | 81        | 159·0           | 64·2              | 15·83      | 25    | 8·0   |
| Bloemfontein .. ..                                               | 98·0      | 26    | 54·4     | 3      | 88·0     | 60·8 | 54·7          | 54        | ...             | ...               | 1·53       | 6     | 2·7   |
| Calcutta... ..                                                   | 84·3      | 22    | 49·2     | 12     | 78·5     | 55·2 | 53·8          | 64        | ...             | 41·8              | ·06        | ?     | 4·8   |
| Bombay... ..                                                     | 86·5      | 1     | 63·8     | 24     | 83·7     | 68·0 | 63·2          | 66        | 130·1           | 53·9              | ·00        | 0     | 0·4   |
| Madras ... ..                                                    | 86·5      | 30    | 63·1     | 14     | 84·2     | 67·8 | 65·0          | 73        | 136·4           | 59·4              | ·14        | 1     | 3·1   |
| Kodaikanal ... ..                                                | 73·3      | 4     | 43·6     | 9, 28  | 66·5     | 47·4 | 41·2          | 60        | 143·3           | 19·3              | ·27        | 4     | 4·6   |
| *Colombo, Ceylon ... ..                                          | 89·4      | 28    | 68·2     | 22     | 83·1     | 72·1 | 71·9          | 83        | 157·9           | 64·0              | 8·34       | 17    | 8·0   |
| Hongkong ... ..                                                  | 72·9      | 9     | 44·0     | 26     | 64·5     | 54·8 | 49·6          | 69        | ...             | ...               | 1·03       | 5     | 4·9   |
| Sydney ... ..                                                    | 100·6     | 25    | 59·0     | 22     | 80·2     | 65·8 | 60·4          | 65        | 155·8           | 48·2              | ·71        | 9     | 4·6   |
| Melbourne ... ..                                                 | 101·5     | 13    | 46·6     | 27     | 75·8     | 56·8 | 48·8          | 52        | 157·1           | 40·0              | ·37        | 3     | 4·5   |
| Adelaide ... ..                                                  | 109·1     | 27    | 48·8     | 5      | 84·1     | 58·6 | 50·3          | 44        | 166·0           | 42·7              | ·19        | 1     | 3·1   |
| Perth ... ..                                                     | 101·8     | 21    | 54·0     | 12     | 83·5     | 62·8 | 56·0          | 54        | 165·7           | 49·6              | ·13        | 4     | 2·5   |
| Coolgardie ... ..                                                | 110·0     | 22    | 51·8     | 13     | 91·0     | 62·3 | ...           | ...       | 170·2           | 49·0              | ·15        | 3     | 3·0   |
| Hobart, Tasmania ... ..                                          | 97·8      | 13    | 40·3     | 27     | 70·3     | 52·1 | 44·7          | 51        | 151·8           | 33·2              | 1·38       | 8     | 5·9   |
| Wellington ... ..                                                | 79·8      | 16    | 47·8     | 28     | 68·7     | 57·4 | 53·7          | 72        | 146·6           | 36·0              | 5·03       | 7     | 6·7   |
| Auckland ... ..                                                  | 79·5      | 22    | 49·0     | 28     | 72·2     | 58·5 | 58·2          | 79        | 149·0           | 46·0              | 2·64       | 12    | 5·7   |
| Jamaica, Kingston ... ..                                         | 90·1      | 6     | 66·1     | 22     | 86·5     | 68·6 | 67·1          | 74        | ...             | ...               | ·09        | 3     | ...   |
| Grenada ... ..                                                   | 87·0      | 2     | 69·0     | 12, 18 | 81·5     | 72·2 | ...           | 78        | 140·0           | ...               | 9·77       | 20    | 4·5   |
| Toronto ... ..                                                   | 51·6      | 17    | 3·7      | 9      | 37·8     | 24·8 | ...           | ...       | 94·0            | —2·7              | 4·36       | 15    | ...   |
| Fredericton ... ..                                               | 51·4      | 3     | —11·0    | 10     | 31·3     | 12·4 | 18·0          | 85        | ...             | ...               | 4·07       | 15    | 6·0   |
| St. John, N.B. ... ..                                            | 51·5      | 3     | —1·0     | 10, 29 | 37·0     | 19·7 | 23·0          | 76        | ...             | ...               | 4·27       | 15    | 6·2   |
| Edmonton, Alberta ... ..                                         | 46·4      | 28    | —32·2    | 11     | 8·2      | —8·2 | ...           | 80        | 88·2            | —34·5             | 1·52       | 20    | 5·9   |
| Victoria, B.C. ... ..                                            | 50·0      | 25    | 21·0     | 19     | 40·4     | 31·8 | 34·0          | 91        | ...             | ...               | 4·54       | 20    | 7·1   |

\* The observations are now taken at the Observatory, not at the Fort.

MALTA.—Mean temp. of air 56°·7. Bright sunshine, daily average 5·3 hours.

Johannesburg.—Bright sunshine 276·0 hours.

Mauritius.—Mean temp. of air 1°·8 below, and R 8·22 in. above, averages. Mean hourly velocity of wind 11·2 miles or 0·2 miles above averages.

KODAIKANAL.—Bright sunshine 212 hours.

COLOMBO.—Mean temp. of air 77°·6 or 1°·1 below, of dew point 2°·1 above, and R 4·25 in. above, averages. Mean velocity of wind 5·7 miles per hour. TS on 5 days.

HONGKONG.—Mean temp. of air 59°·2. Mean hourly velocity of wind 11·5 miles. Bright sunshine 198·8 hours.

Sydney.—Mean temp. of air 1°·4 above, and R 2·87 in. below, averages.

Melbourne.—Mean temp. of air 1°·2 below, and R 1·48 in. below, averages.

Adelaide.—Mean temp. of air 2°·8 below, and R ·54 in. below, averages.

Coolgardie.—Mean temp. of air 3°·1 above average.

Hobart.—Mean temp. of air 0°·5 below, and R ·60 in. below, averages.

Wellington.—R 1·71 in. above average. Bright sunshine 226·4 hours.

# Symons's Meteorological Magazine.

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## “BRITISH RAINFALL, 1912.”

THE annual volume of *British Rainfall* is published this year somewhat earlier than has been the case lately. In plan and arrangement it is the same as in recent years, the series of changes which have gradually been introduced having now led to a form of treatment which will probably be found suitable for some years to come.

In the Director's Report to the Trustees, Dr. Mill gives an account of the work of the Organization for the year ending July 23rd, and suggests a change in the charge for certificates of accuracy for a rain gauge and measuring glass. This was sanctioned by the Trustees, and the rate fixed at 1s. 6d. when gauge and glass are sent together. The charge for a certificate of accuracy for a rain measuring glass alone, remains as before at 1s.

At the end of his Report, Dr. Mill said “I have with much regret to state that acting on medical advice, I have very reluctantly consented to take a long and complete rest. The continual strain of the work has in particular, seriously affected my eyesight, and for several months I have been unable to read or write, and have had to carry on my work in a tedious and unsatisfactory way, through the eyes of others.” The Trustees sanctioned the appointment of Mr. R. C. Mossman of the Argentine Meteorological Office, as Acting Editor of Publications for one year from October 1st, and of Mr. Carle Salter, Chief Assistant in the British Rainfall Organization office, to the temporary position of Assistant Director for one year from the same date. It is understood that Mr. Mossman and Mr. Salter will carry on between them the whole of the work hitherto done by Dr. Mill, who hopes to return after the greater part of a year spent in travelling.

As Dr. Mill's eyes have prevented him from personal revision of the proof of the volume just issued, the whole of this work has been done by Mr. Salter, whose name appears on the title-page as sharing in the responsibility for the correctness of the work.

Part I. is devoted mainly to two very remarkable phenomena in 1912, viz., the great rain storm of August 25th-26th, which, in East Anglia, reached proportions surpassing those of any previously recorded rain storm in the British Isles, this article being illustrated

by a coloured map of the district most seriously affected; and the rainfall of the summer of 1912 in England and Wales, which, although approached in the summer of 1879, was never exceeded in any summer during the last fifty years. The treatment of the great storm extends the discussion given in Dr. Mill's paper read to the Royal Meteorological Society in November, 1912, from East Anglia to the whole of England and Wales. Part I. also contains the usual section on Evaporation observations, and concludes with an article describing in detail the changes in the Staff of Observers during the year, and an Obituary list with biographical notices of many of the 89 Observers who have died since the publication of *British Rainfall*, 1911. The increase in the number of records printed was 198, equal to the gains in the previous year and the largest ever recorded. The total number of records printed amounts to 5,272.

Amongst the Observers' Notes on the Weather of 1912 is an account of the remarkable glazed frost of January 17th. A photograph of one of the beautiful effects produced by this frost forms the frontispiece of the book.

The number of records of the duration of rainfall has been considerably increased. Two of the months of 1912 were remarkable from the point of view of their rainfall, April, with a general rainfall of 35 in. for the whole of England and Wales, sharing with April, 1893, the distinction of being the driest month of that name in the last 50 years, and August, with a general rainfall of 6.86 in. for England and Wales, having had more than an inch of excess over the previous wettest August on record. The rainfall of the six months from October, 1911, to March, 1912, was also very remarkable, exceeding 150 per cent. of the average in the south of England and Wales, and reaching 180 per cent. in Monmouthshire. The rainfall of the six summer months, April—September, 1912, also reached 180 per cent. of the average in Norfolk.

The section on the relation of the total rainfall of the year to the average, is illustrated by a coloured map showing the rainfall in different parts of the British Isles, expressed as a percentage of the average amount. The most interesting feature is the strip of extremely high rainfall which occupied the south-west, centre and east of England. Within this strip, a large area had more than 30 per cent. above the average rainfall for the year, and three patches had more than 40 per cent. excess. The relation of the general rainfall over the great divisions of the kingdom to the average, was as follows, the rainfall being expressed in the form of a percentage:—England, 123; Wales, 119; England and Wales, 122; Scotland, 111; Ireland, 108; British Isles, 115.

The year as a whole was thus a wet one, and it is an interesting fact that 1910-1912, was the eighth successive three year period, in which the third year had a greater general rainfall in England and Wales than either of the two preceding years, though on this occasion for the first time the two preceding years were not both dry years.

## SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

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

(of the Argentine Meteorological Office).

## Fourth Article.

A PRONOUNCED feature of many correlations is their temporary character, this applying more particularly to pairs of stations not located in action centres, but situated in intermediate zones, where correlations are set up without any apparent reason, persist with varying degrees of intensity for fluctuating periods, and disappear with the same abruptness that initiated their commencement. An interesting example of this nature is shown by a comparison of the April to September rainfall at Trinidad, West Indies (lat.  $10^{\circ} 40' N.$ , long.  $61^{\circ} 31' W.$ ), and the rainfall at Azo, Argentine Republic (lat.  $36^{\circ} 31' S.$ , long.  $56^{\circ} 46' W.$ ) for the six months following.

The data referring to Trinidad are based on a table of monthly and annual rainfall from 1862 to 1910,\* kept at the Royal Botanic Gardens, which was included among a large mass of valuable printed data referring to British Colonial stations, recently received from the London Meteorological Office. The data from Azo are from a manuscript record kept at Estancia Linconia kindly furnished by Mr. Herbert Gibson. The observations, which are still continued, cover the period, 1858—1911, thus embracing 54 years (see Table I.) The values up to the year 1884 have already appeared in a paper,† published a quarter of a century ago, from the pen of the late Mr. Thomas Gibson, who initiated the observations.

Whatever may be the causes that determine the general character of the rainy season at Trinidad, *i.e.*, whether the rain will be above or below the normal, the character of the season is usually impressed on the records as early as April and May. If we take the combined rainfall of these two months for the 50 years, 1862—1911, and compare the values with those of the four months following, we find 36 years in which the deviation from the normal was represented by the same sign as the corresponding June to September values, and 14 cases in which they differed. In the 20 years, 1876—1895, during which the pronounced opposition with Azo prevailed, there is only one year (1878) in which the April and May rainfall at Trinidad was not a direct index of that of the four succeeding months.

\* I am obliged to Mr. W. G. Freeman, B.Sc., Government Botanist of the St. Clair Experiment Station, Trinidad, for the monthly rainfall there during the years 1911 and 1912. The data are as follows:—

|          | Jan. | Feb. | Mar. | Apr. | May. | June. | July. | Aug.  | Sept. | Oct.  | Nov. | Dec. | Year. |
|----------|------|------|------|------|------|-------|-------|-------|-------|-------|------|------|-------|
|          | in.  | in.  | in.  | in.  | in.  | in.   | in.   | in.   | in.   | in.   | in.  | in.  | in.   |
| 1911 ... | 1·61 | 1·51 | 1·36 | ·74  | 1·27 | 7·15  | 4·73  | 13·68 | 4·03  | 10·22 | 3·57 | 3·53 | 53·90 |
| 1912 ... | ·62  | ·20  | ·74  | ·03  | 2·18 | 7·54  | 12·16 | 5·56  | 5·58  | 2·73  | 6·28 | 5·64 | 49·26 |

† *Jour. Scot. Met. Soc.*, 3rd Series, Vol. 7, p. 192.



TABLE I.—*Rainfall at Estancia Linconia, Azo, Province of Buenos Aires.*  
 Lat. 36° 31' S. Long. 56° 46' W. Distance from sea 12 miles. Gauge 5 feet above ground.

|         | Jan. | Feb. | March. | April. | May. | June. | July. | August. | Sept. | Oct. | Nov. | Dec. | Y. E.A.R. |
|---------|------|------|--------|--------|------|-------|-------|---------|-------|------|------|------|-----------|
|         | in.  | in.  | in.    | in.    | in.  | in.   | in.   | in.     | in.   | in.  | in.  | in.  | in.       |
| 1858... | 2.39 | 2.00 | 3.26   | 1.01   | 8.22 | 2.49  | 1.47  | 2.07    | 7.25  | 4.22 | 3.62 | 2.37 | 40.37     |
| 1859... | .72  | 1.22 | 2.00   | 1.77   | 3.91 | 1.24  | 2.45  | 1.93    | 2.57  | 1.86 | 3.27 | .49  | 23.43     |
| 1860... | .86  | 5.48 | 6.74   | 2.01   | 6.85 | 6.20  | 2.97  | 2.96    | 1.34  | 4.83 | 2.31 | .81  | 43.36     |
| 1861... | .07  | 3.00 | 1.15   | 5.40   | .87  | .55   | .29   | 3.26    | 1.10  | 3.09 | .59* | .62  | 19.99*    |
| 1862... | 1.18 | .64  | 4.75   | 1.00   | 5.67 | 8.32  | 2.93  | .62     | 1.09  | 1.20 | 3.55 | 2.59 | 33.54     |
| 1863... | 4.04 | 1.19 | 1.81   | 1.10   | 1.52 | 5.20  | .70   | .32     | 2.56  | 3.15 | 1.89 | 2.27 | 25.75     |
| 1864... | 1.54 | 1.94 | .54    | 6.60   | 3.85 | 5.61  | 2.13  | 3.71    | 2.59  | 3.26 | 1.80 | 6.78 | 40.35     |
| 1865... | 5.61 | 2.93 | 3.42   | 3.26   | 3.38 | 5.42  | 2.33  | 2.17    | 2.26  | 3.75 | 1.37 | 1.63 | 37.53     |
| 1866... | .25  | .96  | 1.55   | 2.21   | 6.69 | 1.77  | 2.93  | 3.09    | 1.97  | 3.88 | 2.96 | 1.52 | 29.78     |
| 1867... | .82  | .75  | 2.00   | 3.69   | 2.62 | 1.15  | 2.33  | 2.12    | .45   | .70  | 4.17 | 2.22 | 22.92     |
| 1868... | 4.46 | 1.94 | 7.65   | .20*   | .44  | 3.20  | .46   | 2.05    | 4.47  | 4.32 | 3.19 | 2.80 | 35.18     |
| 1869... | 7.12 | 2.63 | 2.69   | 3.03   | .25  | .00*  | .76   | .00*    | 4.33  | 2.00 | 5.07 | 4.97 | 32.85     |
| 1870... | 2.05 | 4.28 | 3.60   | 3.29   | 3.84 | .57   | 1.32  | .25     | .00*  | 2.54 | 5.24 | .56  | 27.54     |
| 1871... | 2.10 | 7.46 | 7.11   | 2.41   | .74  | 6.10  | .00*  | 1.70    | 1.12  | 2.48 | 1.48 | 4.46 | 37.16     |
| 1872... | 6.16 | 2.60 | 3.15   | 1.92   | 1.82 | 3.37  | 1.84  | 5.32    | .87   | 1.12 | 3.15 | 3.56 | 34.88     |
| 1873... | 4.86 | 4.47 | .00*   | 2.80   | .88  | 1.83  | .00*  | 2.65    | 2.29  | 2.26 | 3.15 | 2.07 | 27.26     |
| 1874... | 1.49 | 2.65 | 2.00   | 1.20   | 5.03 | 1.82  | 2.96  | 5.10    | 4.08  | 4.77 | 3.76 | .75  | 35.61     |
| 1875... | 3.94 | 2.10 | .50    | 5.11   | 2.55 | .47   | 2.10  | 1.07    | 1.04  | 1.96 | .86  | 1.32 | 23.02     |
| 1876... | 2.64 | 3.42 | 5.35   | 4.61   | 2.90 | 3.62  | 2.82  | 3.46    | .57   | 3.18 | 2.06 | 1.79 | 36.42     |
| 1877... | .00* | 1.60 | 5.78   | 3.37   | 5.82 | 2.59  | 6.52  | 2.97    | .85   | 3.33 | 2.01 | 4.29 | 39.13     |
| 1878... | 4.32 | .55  | 4.23   | 5.10   | 2.30 | 4.42  | 1.28  | 1.11    | .70   | 3.80 | 3.37 | 3.30 | 34.48     |
| 1879... | 1.38 | 2.42 | 5.80   | .68    | 4.25 | 6.12  | 2.08  | .75     | 1.25  | 1.00 | 2.62 | .86  | 29.21     |
| 1880... | 5.88 | 2.28 | 3.57   | .59    | 1.99 | 4.03  | 1.80  | 1.22    | 1.48  | 1.83 | 4.39 | 3.56 | 32.62     |
| 1881... | 2.92 | 1.48 | 1.27   | 2.33   | .57  | 4.85  | 2.64  | 1.61    | 6.92  | 5.20 | 2.03 | 1.20 | 33.02     |
| 1882... | 2.67 | 1.33 | 2.02   | 2.15   | .87  | 1.19  | 1.13  | 4.65    | 1.28  | 2.45 | 1.63 | 1.52 | 22.89     |
| 1883... | 3.96 | .35* | 7.92   | 1.78   | 2.67 | 5.07  | 4.15  | 2.14    | 2.24  | 3.42 | 2.95 | 1.45 | 38.10     |
| 1884... | 1.18 | .77  | 2.37   | 5.52   | .25  | 2.37  | .65   | 2.12    | 12.64 | 3.02 | 1.49 | 2.15 | 34.53     |
| 1885... | 3.02 | 6.40 | 7.41   | 3.00   | 3.00 | 2.34  | 1.82  | 1.69    | 2.13  | 4.15 | 2.90 | 6.44 | 44.30     |
| 1886... | 3.56 | .67  | 6.19   | 2.94   | 1.71 | 2.62  | .35   | .54     | 3.05  | 3.90 | .95  | 3.40 | 29.88     |
| 1887... | 1.10 | 4.18 | 1.45   | 2.72   | .00* | 6.95  | 1.05  | 2.88    | 1.60  | 3.39 | 2.02 | 4.63 | 31.97     |

TABLE I.—*Rainfall at Estancia Linconia, Azo, Province of Buenos Aires—(continued).*

|         | Jan.  | Feb. | March. | April. | May. | June. | July. | August. | Sept. | Oct. | Nov. | Dec. | Year. |
|---------|-------|------|--------|--------|------|-------|-------|---------|-------|------|------|------|-------|
|         | in.   | in.  | in.    | in.    | in.  | in.   | in.   | in.     | in.   | in.  | in.  | in.  | in.   |
| 1888... | 4.42  | 2.27 | 3.50   | 5.32   | .36  | 2.54  | 5.47  | 3.50    | 2.76  | 2.67 | 1.54 | 4.53 | 38.88 |
| 1889... | 12.30 | 2.59 | 3.09   | 3.33   | 2.43 | 2.76  | 3.32  | 3.88    | 1.47  | .40* | 3.09 | 1.49 | 40.15 |
| 1890... | 1.99  | 2.25 | 4.02   | 3.24   | 1.75 | 2.20  | 4.52  | 2.57    | .95   | 1.13 | 1.38 | 2.43 | 28.43 |
| 1891... | 2.59  | 3.39 | 2.95   | .54    | 3.97 | 1.24  | 3.11  | 4.47    | .26   | 4.77 | 2.73 | 4.57 | 34.59 |
| 1892... | 1.90  | 1.59 | 3.67   | .72    | 2.92 | .12   | 2.57  | 2.50    | 5.33  | 4.74 | 1.61 | 1.71 | 29.38 |
| 1893... | 2.53  | .50  | 2.96   | 3.28   | .66  | .89   | 3.64  | 1.67    | .33   | 1.54 | 2.66 | .54  | 21.20 |
| 1894... | 3.05  | 1.75 | .97    | .22    | 1.59 | .80   | 1.50  | 3.43    | 2.35  | 6.62 | 3.67 | 2.92 | 28.87 |
| 1895... | 3.34  | 2.09 | 10.91  | 1.95   | .55  | 1.89  | 2.48  | 3.01    | 3.64  | 1.40 | 4.15 | 4.38 | 39.79 |
| 1896... | 2.04  | 1.49 | 1.47   | 2.61   | .83  | .82   | 5.59  | 2.48    | 4.98  | 2.77 | 3.20 | .47* | 28.75 |
| 1897... | .93   | 2.74 | 3.37   | 1.00   | 3.06 | 2.28  | 1.13  | .59     | 3.46  | 2.45 | 3.45 | 2.90 | 27.36 |
| 1898... | 4.15  | 2.03 | 5.57   | 3.55   | 3.33 | 5.94  | 1.31  | 2.37    | 4.16  | 2.71 | 1.71 | 1.62 | 38.45 |
| 1899... | 2.31  | 3.53 | 4.51   | 4.92   | 5.39 | 1.85  | 6.47  | 10.21   | .54   | 2.62 | 3.39 | 5.18 | 50.92 |
| 1900... | 2.43  | 3.89 | 15.88  | .79    | 5.21 | 3.40  | 5.87  | 5.57    | 6.28  | 3.96 | 5.26 | 1.24 | 59.78 |
| 1901... | 2.21  | 2.71 | 2.02   | 3.07   | 9.67 | 1.28  | .50   | 3.78    | 1.48  | 2.12 | 3.48 | 2.32 | 34.64 |
| 1902... | 3.05  | 1.38 | 4.33   | 2.36   | 3.72 | 1.10  | 1.32  | 1.14    | 2.49  | .93  | 1.63 | 2.93 | 26.38 |
| 1903... | 2.94  | 2.42 | 4.11   | 3.21   | 2.20 | 5.24  | 1.81  | 3.92    | 2.47  | 1.46 | 2.59 | 4.99 | 37.36 |
| 1904... | 4.24  | 6.16 | 5.08   | 4.76   | .45  | 1.97  | 3.90  | 5.18    | .89   | 5.61 | 2.28 | .53  | 41.05 |
| 1905... | 1.54  | 2.24 | 2.07   | 4.17   | 1.63 | 3.46  | 1.99  | .00*    | 2.22  | 6.98 | 1.34 | 4.30 | 31.94 |
| 1906... | .81   | 1.91 | 2.26   | 6.10   | 3.54 | 2.46  | 3.70  | 3.68    | 6.70  | 3.65 | 1.91 | 2.94 | 39.66 |
| 1907... | 1.09  | .40  | 8.87   | 6.69   | .00* | 2.91  | 2.76  | 4.11    | 2.07  | 3.32 | .77  | 1.99 | 34.98 |
| 1908... | 1.47  | 1.65 | 2.53   | 6.90   | 1.06 | 2.68  | 1.29  | 1.87    | .59   | 2.03 | 4.28 | 1.52 | 27.87 |
| 1909... | 4.74  | 2.42 | .73    | 1.18   | .22  | 2.88  | 3.52  | 3.14    | 4.83  | 2.59 | 3.09 | 2.97 | 32.31 |
| 1910... | 2.93  | 2.18 | 3.02   | .75    | .39  | 2.03  | 2.00  | 3.11    | 1.46  | 1.74 | 2.06 | .68  | 22.35 |
| 1911... | 6.62  | 3.65 | .24    | 2.57   | 6.22 | .65   | 2.39  | 1.28    | .98   | 4.20 | 1.78 | 6.77 | 37.35 |
| Mean... | 2.93  | 2.42 | 3.80   | 2.89   | 2.72 | 2.87  | 2.38  | 2.63    | 2.57  | 3.01 | 2.65 | 2.64 | 33.51 |
| 1912... | 5.10  | 2.17 | 6.93   | 2.99   | 3.47 | 3.97  | 1.42  | 2.15    | 1.66  | 3.80 | 5.89 | 1.29 | 40.84 |
| 1913... | .07   | 1.97 | 8.46   | —      | —    | —     | —     | —       | —     | —    | —    | —    | —     |

Dealing with the 50 years, 1862 to 1911, common to both series of observations (see Table II.) we find that from 1862 to 1877, and from 1895 to 1911, there was no relation between the rainfall at Trinidad from April to September and that at Azo during the six months following. On the other hand during the 17 years, 1878 to 1894, the two curves are the reverse of each other. These results apply to the values referred to the 50 years' means, which are 40·47 in. for Trinidad, and 17·85 in. at Azo.

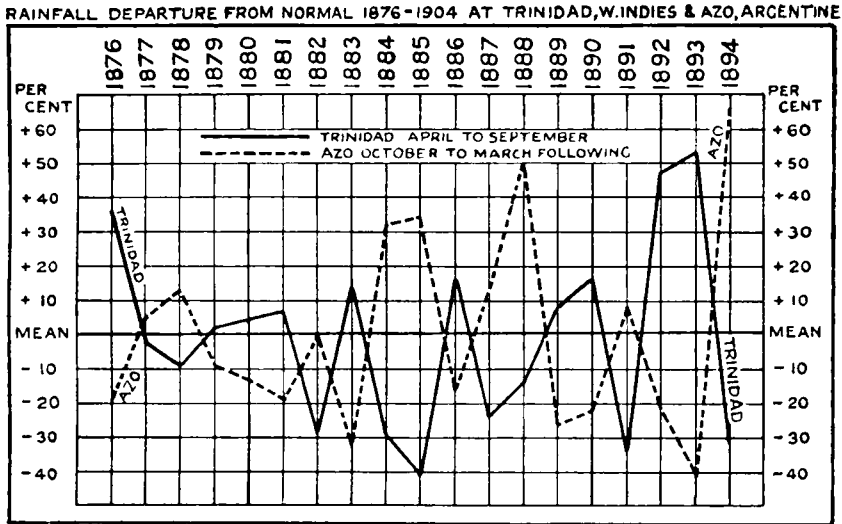
TABLE II.—*Rainfall at Trinidad (Lat. 10° 40' N., Long. 61° 31' W.) and Azo (Lat. 36° 31' S., Long. 56° 46' W.)*

| Year. | Trinidad.<br>April to<br>September. | Azo. Oct.<br>to March<br>following. | Departure<br>from Normal. |     | Year. | Trinidad.<br>April to<br>September. | Azo. Oct.<br>to March<br>following. | Departure<br>from Normal. |     |
|-------|-------------------------------------|-------------------------------------|---------------------------|-----|-------|-------------------------------------|-------------------------------------|---------------------------|-----|
|       | in.                                 | in.                                 | %.                        |     |       | in.                                 | in.                                 | %.                        |     |
| 1862  | 42·03                               | 14·38                               | + 4                       | —19 | 1889  | 46·68                               | 13·24                               | +15                       | —26 |
| 1863  | 43·99                               | 11·33                               | + 9                       | —36 | 1890  | 50·35                               | 13·87                               | +24                       | —22 |
| 1864  | 40·42                               | 23·80                               | 0                         | +34 | 1891  | 33·10                               | 19·23                               | —18                       | + 8 |
| 1865  | 49·36                               | 9·51                                | +22                       | —47 | 1892  | 63·73                               | 14·05                               | +57                       | —21 |
| 1866  | 35·17                               | 11·93                               | —13                       | —31 | 1893  | 66·48                               | 10·51                               | +64                       | —41 |
| 1867  | 46·81                               | 21·14                               | +16                       | +19 | 1894  | 29·24                               | 29·55                               | —28                       | +66 |
| 1868  | 36·13                               | 22·75                               | —11                       | +28 | 1895  | 22·75                               | 14·93                               | —44                       | —16 |
| 1869  | 34·39                               | 21·97                               | —15                       | +23 | 1896  | 34·71                               | 13·48                               | —14                       | —24 |
| 1870  | 46·51                               | 25·01                               | +15                       | +40 | 1897  | 48·64                               | 20·55                               | +20                       | +15 |
| 1871  | 46·30                               | 20·33                               | +14                       | +14 | 1898  | 42·67                               | 16·39                               | + 5                       | — 8 |
| 1872  | 29·96                               | 17·16                               | —26                       | — 4 | 1899  | 23·97                               | 33·39                               | —41                       | +86 |
| 1873  | 24·05                               | 13·62                               | —41                       | —24 | 1900  | 45·77                               | 17·40                               | +13                       | — 2 |
| 1874  | 52·81                               | 15·82                               | +30                       | —12 | 1901  | 36·18                               | 16·68                               | —11                       | — 6 |
| 1875  | 38·97                               | 15·55                               | — 4                       | —13 | 1902  | 38·06                               | 14·96                               | — 6                       | —16 |
| 1876  | 58·93                               | 14·41                               | +45                       | —19 | 1903  | 38·80                               | 24·52                               | — 4                       | +37 |
| 1877  | 42·68                               | 18·73                               | + 5                       | + 5 | 1904  | 33·05                               | 14·27                               | —18                       | —20 |
| 1878  | 39·44                               | 20·07                               | — 3                       | +13 | 1905  | 43·15                               | 17·60                               | + 7                       | — 1 |
| 1879  | 44·39                               | 16·21                               | +10                       | — 9 | 1906  | 44·88                               | 18·86                               | +11                       | + 6 |
| 1880  | 45·21                               | 15·45                               | +12                       | —13 | 1907  | 40·23                               | 11·73                               | — 1                       | —34 |
| 1881  | 46·62                               | 14·45                               | +15                       | —19 | 1908  | 30·53                               | 15·72                               | —25                       | —12 |
| 1882  | 30·90                               | 17·33                               | —24                       | 0   | 1909  | 37·92                               | 16·78                               | — 6                       | — 6 |
| 1883  | 49·62                               | 12·04                               | +22                       | —32 | 1910  | 39·67                               | 14·99                               | — 2                       | —16 |
| 1884  | 30·70                               | 23·49                               | —24                       | +32 | 1911  | 31·60                               | 26·95                               | —22                       | +51 |
| 1885  | 25·65                               | 23·91                               | —37                       | +34 |       |                                     |                                     |                           |     |
| 1886  | 50·38                               | 14·98                               | +25                       | —16 | Mean  | 40·47                               | 17·85                               | ...                       | ... |
| 1887  | 32·97                               | 20·23                               | —19                       | +14 |       |                                     |                                     |                           |     |
| 1888  | 37·10                               | 26·72                               | — 8                       | +50 | 1912  | 33·05                               | 21·48                               | —18                       | +21 |

On referring the values to the means of the 19 years, 1876 to 1894, viz., 43·38 in. at Trinidad, and 17·84 in. for Azo, we get an uninterrupted correlation, as will be apparent from the following values showing the percentage of excess or defect referred to the above short average. Under the first year, 1876, is entered the value at Trinidad for April to September of that year, and at Azo for the six months following, i.e., from October, 1876, to March, 1877, and so on.

|                  | 1876 | 1877 | 1878 | 1879 | 1880 | 1881 | 1882 | 1883 | 1884 | 1885 |
|------------------|------|------|------|------|------|------|------|------|------|------|
| Trinidad % ...   | +36  | —2   | — 9  | +2   | + 4  | + 7  | —29  | +14  | —29  | —41  |
| Azo % .....      | —19  | +5   | +13  | —9   | —13  | —19  | 0    | —32  | +32  | +34  |
|                  | 1886 | 1887 | 1888 | 1889 | 1890 | 1891 | 1892 | 1893 | 1894 |      |
| Trinidad % ..... | +16  | —24  | —14  | + 8  | +16  | —34  | +47  | +53  | —33  |      |
| Azo % .....      | —16  | +14  | +50  | —26  | —22  | + 8  | —21  | —41  | +66  |      |

The correlation co-efficient deduced from the above values reaches the high value of 0·79, with probable error of 0·06. The following diagram shows the data in graphic form.



These results are of considerable interest as they show that the physical processes that produced a given precipitation at Trinidad, 11° N. of the equator, during the period under discussion, were associated during the six months following by an opposite effect at Azo in the south temperate zone, some 2,850 geographical miles distant. The effect so far as shown by available material, which embraces five stations in the Argentine Republic\* and two in Brazil, is greatest on the Atlantic seaboard, with a hypothetical maximum out in the ocean some distance to the east of Azo. At Buenos Aires the co-efficient has fallen to —·47, and two stations to the north, situated respectively 190 and 310 miles distant from that city, give values of —·40 and —·52, with probable errors of ·11 and ·13 respectively, that of Buenos Aires being ·12. To the west the relation dies out completely as Cordoba shows a positive correlation of ·17. At Rio de Janeiro (lat. 22° 54' S.) there is a value of —·10, and at Alto da Serra (lat. 23° 40' S., height 2,625 feet), —·38. Had a large number of stations been available for comparison with Trinidad during the 19 years under review it would have been possible to draw, what may in this case be termed *post iso-cohyetal lines*, or lines drawn through points having the same correlation co-efficient. In this way some clue to the precise mechanism governing this correlation might be obtained, since the boundaries of the area covered by the rainfall inversion would be clearly defined for the

\* I am indebted to Mr. W. G. Davis, Director, for permission to examine the Argentine data.

land regions of the south temperate zone. As regards the equatorial and tropical regions it would be desirable to utilise data from other stations north and south of the equator which would indicate the area around Trinidad, or perhaps some more potent centre involved in the correlation. An analysis of the winds at littoral stations on the coast of South America from 38° S. to N. of the equator would also help to throw light over the problem in hand.

An attempt to trace a relation between the April to September rainfall at Trinidad and that of the six months following at some places in Europe, the United States, and other regions has failed, but one or two interesting correlations have shown up which may now be disposed of.

It was noted that the rainfall of Java\* for the six months, October to March, was in general the reverse of that at Trinidad during the six months following, the correlation co-efficient for the 30 years 1880-1909 was  $\cdot 47$  and probable error  $\cdot 11$ , and during the 18 years 1883-1900, when the variation was more pronounced, as high as  $\cdot 37$  with probable error  $\cdot 11$ . During these 18 years the October to March rainfall at Azo agreed in the main with that recorded at Java for the same period of the *previous* year, the result showing a correlation of  $+ \cdot 44$  and a probable error of  $\cdot 13$ .† It was further observed that the January to March rainfall at Baltimore, U.S.A.,‡ and at San Fernando, near Cadiz,§ on the coast of Spain, for the same months during the period 1851-1880 were in general the reverse of each other, the correlation co-efficient being  $- \cdot 57$  and probable error  $\cdot 05$ . After 1880 until 1904, the last year utilized, there is no agreement, so that the correlation co-efficient for the whole period of 54 years falls to  $\cdot 21$ . It is of interest to note that the opposition between the rainfall of Stykkisholm and Brussels discovered by Hann, which was well marked during the 21 years 1857-1878, diminished later and completely disappeared in 1900.|| From which it may be inferred that the physical processes at work involved both the Stykkisholm—Brussels and the Baltimore—Cadiz correlations, since a diminution of intensity was noted about the same time, viz. 1880.

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\* Data from *Regenwaarnemingen in Nederlandsch-Indie*, 1905. Table XV. pp. 510-11. From 1906 to 1909 values computed from data given in subsequent annual volumes.

† For precise value to be assigned to these figures see *Forecasting Weather*, by Dr. W. N. Shaw, F.R.S., p. 362.

‡ Data from Maryland Weather Service, *Climate of Baltimore*, Vol. 2, pp. 186-187.

§ Data from *Schwankungen der Niederschläge*. Von G. Hellmann, Berlin, 1909, p. 1.

|| See Hildebrandsson's fourth paper on "*Centres d'Action de l'Atmosphère*," p. 21.







# THAMES VALLEY RAINFALL — JULY, 1913.



ALTITUDE  
SCALE

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

SCALE OF MILES

0 5 10 15 20

## THE WEATHER OF JULY.

THE British Isles were under the influence of a large anticyclonic system in the beginning of the month, and fair weather prevailed over practically the whole. On the 3rd and 4th a low pressure system over Northern Europe expanded slowly westward, and showers occurred in nearly all parts of Great Britain. Temperature was much below the normal, the maxima being below  $60^{\circ}$  at many northern and eastern stations, and only reaching  $70^{\circ}$  or slightly above in the south of England. Weather of a changeable type continued over England generally, but over Scotland and Ireland it was fair and dry. The low temperature persisted, and on the 8th and 9th readings below  $40^{\circ}$  occurred at Llangammarch Wells, Birr Castle, and many stations in the north-east of England and north of Scotland, and  $34^{\circ}$  at Balmoral. Frequent local thunderstorms occurred over the south-east of England, those on the 10th and 14th being the most severe. At Lewisham  $\cdot 72$  in. of rain fell in 27 minutes during the storm on the 10th. More than an inch of rain fell at many widely distributed stations on the 14th, and more than 3 in. at Mayfield, in the north-east of Sussex. Fine bright weather set in over the western parts of the country and in the extreme north on the 20th, and continued to the end of the month. It was less fine in the east and south-east of England, though hardly any rain fell after the 21st. Temperature rose during the last week, when the maximum readings occurred almost everywhere on 28th or 29th. The highest readings reported were  $83^{\circ}$  at Milton Bryan,  $82^{\circ}$  at Marlborough,  $81^{\circ}$  at Cullompton, and  $80^{\circ}$  at Salisbury, Bath and Clifton.

The month was dry in all parts of the British Isles, except in the areas shown on the accompanying map, where the severe thunderstorms of the 14th caused irregular patches of heavy rainfall. The total rainfall exceeded 2 inches over a number of scattered areas, reaching 5.81 in. at one station in Sussex, but, otherwise, most of England and Wales had less than an inch of rain during the month. Less than an inch fell also over the east of Scotland including a large area in the centre, and over the southern half of Ireland. The fall reached 3 inches practically nowhere outside the thunderstorm area, and a large part of the normally very wet districts in the west of Scotland had only about 1.50 in. during the month. The south of Ireland and the south-west of England and Wales were relatively the driest parts of the country. The general rainfall expressed as a percentage of the average was: England and Wales, 44; Scotland, 29; Ireland, 33; British Isles, 37.

Sunshine was much more prevalent on the west coast than on the east. Newquay and Turnberry both had rather more than 200 hours, while at Clacton-on-Sea and Nairn less than 135 hours were recorded.



## Correspondence.

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

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## THUNDERSTORM OF JULY 14th—15th.

THE following notes anent a heavy thunderstorm on the night of July 14th—15th, may be of some slight interest. Thunder was heard soon after 1.30 a.m. It gradually approached, and the storm burst on us at almost exactly 2 a.m. Rain began to fall in torrents, the heaviest rain I remember since the storm of May 9th, 1906. When the lightning flashes occurred, the rain appeared like a continuous sheet of falling water, obscuring everything, even a big tree 20 yards from the house. Vivid lightning flashes were comparatively few, and at considerable intervals, but flashes overhead, in or above the clouds, were very frequent. For nearly an hour the thunder was almost continuous, sometimes dying away to a barely audible rumble; but at no time did there seem to be more than a very few seconds without thunder. During this time, it was virtually impossible to associate a lightning flash with any particular clap of thunder for timing purposes. About 2.40 a.m., the storm seemed to be passing away, but it returned, and at 2.50 a.m. seemed again overhead. The rain was now getting less violent, but continued pretty heavy until shortly after 3 a.m., when the storm finally began to move off. By 3.30 it had ceased, and the rain had stopped. As to the amount of rain that fell, I happened to look at the gauge at 6 p.m., when there was .15 in. in it. No rain fell between that and 11 p.m., when it was starlight. Whether any rain fell between then and the beginning of the storm I do not know, but I think probably little or none. My coachman, who is a very early riser, was up about 5 a.m. He tells me there was rain, but not very heavy, for about half an hour between 6 and 7 a.m. At 9 a.m., I found 2.27 in. in the gauge. I think therefore, that one may fairly say that at least 2 inches fell between 1.30 and 3.30 a.m., and most of this must have been between 2 and 3 a.m.

A friend at Stonegate, about  $1\frac{1}{2}$  miles west, and about midway between here and The Olives, told me that she had 2.75 in. in her gauge. Miss Luck, of The Olives, tells me that (speaking from memory) she measured 2.30 in. on the morning of the 15th. She added that she was told that at Wadhurst (2 miles N.W. of there), only about 1.30 in. fell.

The storm seems to have been even more severe a little north of us. At Burnt Lodge, a little east of Whiligh, two large oak trees were struck, one in front of the house, and the other behind it.

ERNEST H. CARTWRIGHT.

*Myskyns, Ticehurst, Sussex, 20th July, 1913.*

It may interest you to have a few particulars of a rather remarkable storm we have just had here. It began yesterday, July 14th, about 2 p.m., when a steady rain commenced, which continued till about 6 p.m. I did not measure the fall up to that hour, but should estimate it at about half an inch. There was no thunder or lightning. No further rain fell until well on in the night. About 11.30 p.m. distant rumblings of thunder began, and it was nearly two hours gradually working up to us, then, about 1.30 a.m., the storm broke with a perfect fury of thunder, lightning and rain. This lasted until about 3 a.m., when the thunder gradually lessened, though the lightning continued until much later. I measured the fall at 10 a.m. and found 3.50 in. in the gauge. Rain, however, still continued all the morning, and I measured again at 2 p.m. to-day, 15th, and found a further .30 in. in the gauge, thus the fall during the twenty-four hours from 2 p.m. on the 14th to 2 p.m. on the 15th was 3.80 in. It has rained slightly at intervals since, and still shows no signs of a definite clearing as I write this at 4 p.m. The two rather unusual features of this storm were, first, the long time the thunderstorm took approaching before it finally broke overhead, and secondly, the fact that the heaviest downpour of rain *preceded* the actual thunderstorm, i.e., this fell between 1.30 and 2.15 a.m., the latter hour being the climax of the storm. Also, I may add, there was practically no wind, not even when the storm broke overhead and the rain came down in solid straight lines. The direction of the storm was apparently from N.W. to S.E. The fall of the barometer was slight. It began to drop at 2 a.m. on Monday, 14th, and fell slowly from 29.85 in. until 4 a.m. on Tuesday, when it reached 29.70 in.; since then it has risen again very slowly. This is the heaviest rainfall I have ever recorded, or my father either, and his records go back over thirty years.

A. G. ROBINS, M.I.M.E.

*Bishopstone, Mayfield, Sussex, July 15th, 1913.*

I would like to add that our fall for the month of July totalled 5.81 in., which fell on 17 days. Temperature was abnormally low, failing to rise above 60° on four days, and only reaching 70° on four days. The minimum was 43° on the 7th. Altogether it has been an exceptional month.

A. G. R.

*August 2nd, 1913.*

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### SUMMER TEMPERATURE.

On the 23rd of July my thermometer registered 58° in the shade at 9 a.m., 54° at noon, 53° at 4 p.m., and 52° at 6 p.m. This morning I have registered 40°, with bright sunshine and cloudless sky. On the 4th January last the minimum temperature was 41°, and on the 5th, 42°.

WILLIAM HALL.

*Swerford, Oxford, August 5th, 1913.*

## FLOODS IN NORTH-WEST WALES.

A GREAT rainfall on June 9th and 10th caused exceptionally high floods in north-west Wales. I have examined the marks made by the flood of December 14th, 1912, on the embankment at Llanrwst, and these showed that it did not reach the top by 5 or 6 inches, but the flood of June 10th overflowed the embankment by at least 3 inches, flooding the meadows and the road.

I went along the rivers Conway and Machno and can confirm the height of the flood as the highest since 1882. In addition to the heavy rain I was told that a big earth slip had taken place at Penmachno, bringing rubbish and one stone of six tons down to the public road. I went to inspect it and found it was the effect of a cloudburst fallen on the lee of the steep hill one mile south-west of Penmachno Church, which occurred, I am informed, when the wind was veering to the west, the marks of the running water in the form of a semi-circle shewing distinctly that it was a cloud burst and not an earth slip as was the local idea.

The following facts relative to the flood may be of interest.

(1) At Cwm Dyli, on Snowdon, some of the rain gauges overflowed. The Llydaw lake rose 3 feet, representing a fall of  $4\frac{1}{2}$  inches of rain over the collecting area. This makes no allowance for the water being drawn off for the power station, nor for the water which had still to flow off the ground, and that temporarily stored in the Glaslyn Lake above, perhaps representing another 1·50 in.

(2) A rain gauge at Penmachno, my native place, near Bettws-y-coed, recorded 4 inches. The Machno river suffered the highest flood since 1882. This fact was ascertained from my known marks observed by a friend.

(3) At Llanrwst a house called Bryn Helig was flooded to a depth of 6 inches. This compares with a flood of 1 inch six years ago, but was a little lower than the big flood of 1882. The rainfall at Bettws-y-coed was 2·35 in., at Llanrwst 1·69 in., and at Llandudno only ·45 in., thus decreasing greatly towards the lower parts according to the distance from the mountain.

(4) I am informed that the overflow over the Caban Coch dam at the Birmingham waterworks was the greatest since the construction of the dams. Newspapers report very high floods in the Festiniog, Machynlleth and Dolgelly districts.

(5) It rained practically all day in the Snowdon district, but here in the Black Mountains rain did not commence until the evening. I find very often that in ordinary west-east cyclones the rain commences three or four hours earlier at Llanrwst than here, and passes off here three or four hours later than there. Llanrwst lies about 100 miles to the north-west of this place.

J. R. GETHIN JONES.

*Capel-y-ffin, Llanthony, Abergavenny, 1st July, 1913.*

## THE CLIMATE OF TORQUAY.

OUR weather here has been most remarkable. We read of heat waves in London and the Thames Valley, and of temperatures well over  $80^{\circ}$ . Here we have only touched  $70^{\circ}$  once this month (on the 16th) and indeed my records show an average maximum for the month up to date of  $63^{\circ}\cdot3$ . Up to May 15th, we had 21.90 in. of rain. Since then there has only been .48 in. and we now need rain badly. I may get a small crop of apples, but pears, plums, and cherries will be a complete failure, and I have no reason to suppose that my neighbours have fared better than myself. This was not due to late frosts, from which indeed we were remarkably free,  $6^{\circ}$  on the night of April 7th, being the lowest since the middle of March, but to very raw sea fogs, and terrible gales, which between them blackened, and crumpled up bud, blossom, and young shoots as if there had been a really heavy frost. Some of the flowering prunus, pyrus, cerasus, and malus were stripped, and are only now putting out some attempts at foliage.

It seems strange that Torquay should have a reputation for fine bright warm winters and stuffy hot relaxing summers. I have resided here for six years now and my experience has been that the winters are terribly wet, sunless, and windy, and that though one may not get as hard frost as further inland—we had  $22^{\circ}$  on February 2nd, 1912—yet the damp makes one feel it more; whereas the summers are generally very cool and pleasant.

JOHN EDWARDS-MOSS.

*Roby Hall, Torquay, 22nd June, 1913.*

## HEAVY RAINFALL AT BRIGHTON.

ON Thursday, July 10th, I registered here 1.96 in. of rain for the twenty-four hours ending 7 a.m., then again this morning, the 14th, another 1.06 in. for the past twenty-four hours.

G. B. HAMLIN.

*40, East Street, Brighton, 14th July, 1913.*

## INTERNATIONAL BALLOON ASCENTS.

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

*November 2nd, 1910.*

| Starting Point   | Country.    | A (H <sub>c</sub> )<br>miles. | B (T <sub>c</sub> )<br>° F. | C<br>miles. | D<br>° F. | E<br>miles. | F        |
|------------------|-------------|-------------------------------|-----------------------------|-------------|-----------|-------------|----------|
| Manchester.....  | England ..  | 4.4                           | —42                         | 11.4        | —56       | 97          | S.E.     |
| Brussels .....   | Belgium ..  | 4.3                           | —53                         | 6.9         | —49       | 49          | E.S.E.   |
| Paris .....      | France ...  | 6.2                           | —51                         | 8.4         | —62       | 237         | E.S.E.   |
| Hamburg .....    | Germany..   | 4.8                           | —65                         | 5.5         | ?         | 37          | N.E.     |
| Lindenberg.....  | „ ..        | 4.5                           | —53                         | 9.3         | —56       | 64          | N.E.     |
| Strassburg ..... | „ ..        | 4.4                           | —51                         | 7.2         | —51       | 86          | E.       |
| Munich .....     | „ ..        | 4.8                           | —47                         | 9.4         | —54       | 109         | N. by E. |
| Pavia .....      | Italy ....  | 6.7                           | —69                         | 8.4         | —69       | 95          | E.       |
| Pavlovsk .....   | Russia .... | 6.6                           | —84                         | 7.0         | —71       | 39          | E.S.E.   |

*November 3rd, 1910.*

| Starting Point.  | Country.   | A (H <sub>c</sub> )<br>miles. | B (T <sub>c</sub> )<br>° F. | C<br>miles. | D<br>° F. | E<br>miles. | F          |
|------------------|------------|-------------------------------|-----------------------------|-------------|-----------|-------------|------------|
| Manchester.....  | England .. | 5·0                           | —54                         | 5·6         | —45       | 13          | E. by N.   |
| Pyrton Hill..... | „ ..       | 4·8                           | —47                         | 10·0        | —58       | 62          | E. by N.   |
| Brussels .....   | Belgium .. | 4·3                           | —49                         | 10·8        | —65       | 89          | S.E. by E. |
| Paris .....      | France ..  | 5·9                           | —56                         | 10·0        | —71       | 212         | S.E. by E. |
| Hamburg.....     | Germany..  | 5·1                           | —67                         | 12·9        | —62       | 44          | E.S.E.     |
| Strassburg ..... | „ ..       | 4·9                           | —56                         | 8·8         | —58       | 86          | E.S.E.     |
| Munich .....     | „ ..       | 4·8                           | —56                         | 6·9         | —51       | 48          | E. by S.   |
| Vienna .....     | Austria .. | 4·9                           | —57                         | 9·6         | —65       | 55          | E.         |
| Pavia .....      | Italy .... | 8·1                           | —74                         | 10·7        | —51       | 129         | E.S.E.     |

*November 4th, 1910.*

|                   |             |      |     |      |     |     |          |
|-------------------|-------------|------|-----|------|-----|-----|----------|
| Manchester.....   | England ..  | 6·2  | —80 | 10·0 | —76 | 37  | S.E.     |
| Pyrton Hill.....  | „ ..        | 5·1  | —51 | 11·0 | —55 | 60  | E.S.E.   |
| Brussels .....    | Belgium ..  | 5·1  | —63 | 8·8  | —65 | 57  | E. by S. |
| Paris .....       | France ..   | *6·2 | —46 | 8·8  | —62 | 236 | E.       |
| Hamburg.....      | Germany..   | 4·6  | —53 | 11·3 | —62 | 85  | E. by S. |
| Lindenberg ....   | „ ..        | 5·2  | —54 | 9·3  | —58 | 30  | E. by N. |
| Strassburg .....  | „ ..        | †    | —   | 7·1  | —55 | 145 | E.       |
| Manich .....      | „ ..        | *9·5 | —45 | 9·8  | —71 | 156 | E.       |
| Vienna .....      | Austria ..  | †    | —   | 12·2 | —74 | 108 | E.       |
| Pavia .....       | Italy ....  | 7·1  | —72 | 9·9  | —78 | 120 | E.       |
| Nizhni Olchedaëff | Russia .... | 5·1  | —55 | 8·1  | —53 | 97  | E.S.E.   |

A Height in miles of commencement of isothermal column.

B Temperature, F°, at bottom of column.

C Greatest height of reliable record in miles.

D Temperature, F°, at greatest height.

E Distance in miles of point where balloon fell.

F Bearing of falling point from starting point.

\* Very indefinite.

† To indefinite to be determined.

The figures are noticeable for the very low values of H<sub>c</sub> in column A. Values below 5·0 miles (8 km.) are decidedly rare, and values below 4·4 very rare indeed. The general and continued drift to the eastward over the whole area is also remarkable. The ascents at Manchester and Pyrton Hill on the 4th were not simultaneous, that at Manchester being in the evening and at Pyrton Hill in the morning. The period was one of very general low pressure, and on the evening of the 3rd the centre of a deep depression passed directly over Pyrton Hill, moving from W.N.W. The case is interesting as the detailed figures of the two ascents, before and after, showed no appreciable difference, and I believe that apart from chance variations there is almost perfect symmetry about the centre of a cyclone with regard to the temperature of the upper air and the value of H<sub>c</sub>.

## REVIEWS.

*The Climate and Weather of San Diego, California.* Prepared under the direction of Willis L. Moore, Chief United States Weather Bureau, by FORD A. CARPENTER, Local Forecaster. Illustrated. San Diego Chamber of Commerce, 1913. Size 7 × 5, pp. x. + 118.

AN attractively written little book on the most delightful climate in the world. So charmingly are the pleasures of the San Diego climate set forth, and so conscientiously buttressed with official figures that the poor Britisher who reads of this climatic Eden feels like Tantalus when he reflects that he can, at the best, only hope to sample the joys of San Diego as a passing wanderer. Mr. Carpenter writes lovingly of the climate he has studied, which notwithstanding the latitude is cool in summer, and because of the latitude warm in winter, with sunshine on practically every day in the year, with a duration of 211 hours for the least sunny month and 297 for the most sunny. Almost all the conditions of climate are remarkable in showing a small range, the temperature exceeding 90° less frequently than in London, but on the other hand only falling to the freezing point once in more than sixty years. The rainfall, however, is extremely erratic, the average annual fall being 9·62 in., while the driest year had only 3·75 in., and the wettest had 25·97 in.

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*La Variazione diurna della Temperatura in Italia.* [The diurnal variation of temperature in Italy]. FILIPPO EREDIA. (Estratto dagli Annali del R. Ufficio Centrale di Meteorologia e Geodinamica, Vol. 34, Parte I., 1912). Rome, 1912. Size 13½ × 9½, pp. 44.

THIS deals with the mean maximum and minimum daily temperature, and the mean daily variation at 120 Italian stations. At Milan in the heart of the Lombard plain, a region as hot in summer as any in Italy, the mean maxima for April—September, are 66°·2, 73°·4, 82°·7, 87°·9, 85°·6, 77°·1, so that the hottest English summer on record, that of 1911, with the mean daily July maximum of 81°·0 in the south of England, would be exceptionally chilly in Italy. In winter, however, the plain of Lombardy is, with the exception of the mountain regions, the only really cold part of the country, the nightly minimum averaging 30°·3 at Milan and 29°·3 at Turin, somewhat lower, that is to say, than in London. The general character of the weather, notwithstanding, being sunny, dry and calm, is milder than in London, and the cold is of short duration in comparison with higher latitudes. In Rome the mean daily variation of temperature is highest, 21°·2, in July, lowest, 12°·6, in December, and throughout the country the figures show a tendency to be greatest in July, and not in May, as in England, the greatest range occurring just after midsummer, instead of before. The mean daily variation for the year is highest, 21°·2, at Palermo in Sicily, and lowest, 7°·9, at Allassio, near Genoa.

L.C.W.B.

## RAINFALL TABLE FOR JULY, 1913.

| 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. | 1913.<br>in. |
| Camden Square.....                   | <i>London</i> .....          | 51 32      | 0 8                  | 111                            | 2'57                           | 2'31         |
| Tenterden.....                       | <i>Kent</i> .....            | 51 4       | *0 41                | 190                            | 2'21                           | 1'64         |
| Arundel (Patching).....              | <i>Sussex</i> .....          | 50 51      | 0 27                 | 130                            | 2'46                           | 2'47         |
| Fawley (Cadland).....                | <i>Hampshire</i> .....       | 50 50      | 1 22                 | 52                             | 2'42                           | 1'16         |
| Oxford (Magdalen College).....       | <i>Oxfordshire</i> .....     | 51 45      | 1 15                 | 186                            | 2'43                           | '80          |
| Wellingborough (Croyland Abbey)..... | <i>Northampton</i> .....     | 52 18      | 0 41                 | 174                            | 2'54                           | 1'29         |
| Shoeburyness.....                    | <i>Essex</i> .....           | 51 31      | *0 48                | 13                             | 1'73                           | 2'55         |
| Bury St. Edmunds (Westley).....      | <i>Suffolk</i> .....         | 52 15      | *0 40                | 226                            | 2'68                           | 1'16         |
| Geldeston [Beccles].....             | <i>Norfolk</i> .....         | 52 27      | *1 31                | 38                             | 2'37                           | 3'05         |
| Polapit Tamar [Launceston].....      | <i>Devon</i> .....           | 50 40      | 4 22                 | 315                            | 2'74                           | '48          |
| Rousdon [Lyme Regis].....            | „.....                       | 50 41      | 3 0                  | 516                            | 2'68                           | '27          |
| Stroud (Uphfield).....               | <i>Gloucestershire</i> ..... | 51 44      | 2 13                 | 226                            | 2'75                           | '98          |
| Church Stretton (Wolstaston).....    | <i>Shropshire</i> .....      | 52 35      | 2 48                 | 800                            | 2'58                           | '91          |
| Coventry (Kingswood).....            | <i>Warwickshire</i> .....    | 52 24      | 1 30                 | 340                            | 2'60                           | '82          |
| Boston.....                          | <i>Lincolnshire</i> .....    | 52 58      | 0 1                  | 11                             | 2'35                           | '79          |
| Worksop (Hodsock Priory).....        | <i>Nottinghamshire</i> ..... | 53 22      | 1 5                  | 56                             | 2'35                           | '99          |
| Macclesfield.....                    | <i>Cheshire</i> .....        | 53 15      | 2 7                  | 501                            | 3'41                           | 1'56         |
| Southport (Hesketh Park).....        | <i>Lancashire</i> .....      | 53 38      | 2 59                 | 38                             | 2'92                           | 1'33         |
| Arncliffe Vicarage.....              | <i>Yorkshire, W.R.</i> ..... | 54 8       | 2 6                  | 732                            | 4'75                           | '90          |
| Wetherby (Ribston Hall).....         | „.....                       | 53 59      | 1 24                 | 130                            | 2'56                           | 1'17         |
| Hull (Pearson Park).....             | „ <i>E.R.</i> .....          | 53 45      | 0 20                 | 6                              | 2'39                           | '43          |
| Newcastle (Town Moor).....           | <i>Northumberland</i> .....  | 54 59      | 1 38                 | 201                            | 2'90                           | '47          |
| Borrowdale (Seathwaite).....         | <i>Cumberland</i> .....      | 54 30      | 3 10                 | 423                            | 8'91                           | 1'75         |
| Cardiff (Ely).....                   | <i>Glamorgan</i> .....       | 51 29      | 3 13                 | 53                             | 3'26                           | '51          |
| Haverfordwest.....                   | <i>Pembroke</i> .....        | 51 48      | 4 58                 | 90                             | 3'39                           | '74          |
| Aberystwyth (Gogerddan).....         | <i>Cardigan</i> .....        | 52 26      | 4 1                  | 83                             | 4'03                           | 2'80         |
| Llandudno.....                       | <i>Carnarvon</i> .....       | 53 20      | 3 50                 | 72                             | 2'52                           | 1'67         |
| Cargen [Dumfries].....               | <i>Kirkcudbright</i> .....   | 55 2       | 3 37                 | 80                             | 3'20                           | '63          |
| Marchmont House.....                 | <i>Berwick</i> .....         | 55 44      | 2 24                 | 498                            | 3'30                           | '79          |
| Girvan (Pinmore).....                | <i>Ayr</i> .....             | 55 10      | 4 49                 | 207                            | 3'73                           | '75          |
| Glasgow (Queen's Park).....          | <i>Renfrew</i> .....         | 55 53      | 4 18                 | 144                            | 2'91                           | 1'42         |
| Inveraray (Newtown).....             | <i>Argyll</i> .....          | 56 14      | 5 4                  | 17                             | 4'72                           | 1'50         |
| Mull (Quinish).....                  | „.....                       | 56 34      | 6 13                 | 35                             | 4'12                           | '96          |
| Dundee (Eastern Necropolis).....     | <i>Forfar</i> .....          | 56 28      | 2 57                 | 199                            | 2'84                           | '60          |
| Braemar.....                         | <i>Aberdeen</i> .....        | 57 0       | 3 24                 | 1114                           | 2'65                           | '27          |
| Aberdeen (Cranford).....             | „.....                       | 57 8       | 2 7                  | 120                            | 3'00                           | '69          |
| Cawdor.....                          | <i>Nairn</i> .....           | 57 31      | 3 57                 | 250                            | 3'14                           | 1'09         |
| Fort Augustus (S. Benedict's).....   | <i>E. Inverness</i> .....    | 57 9       | 4 41                 | 68                             | 2'98                           | 1'39         |
| Loch Torridon (Bendamph).....        | <i>W. Ross</i> .....         | 57 32      | 5 32                 | 20                             | 5'35                           | 1'36         |
| Dunrobin Castle.....                 | <i>Sutherland</i> .....      | 57 59      | 3 56                 | 14                             | 2'91                           | 1'32         |
| Wick.....                            | <i>Caithness</i> .....       | 58 26      | 3 6                  | 77                             | 2'67                           | '95          |
| Killarney (District Asylum).....     | <i>Kerry</i> .....           | 52 4       | 9 31                 | 178                            | 3'53                           | '75          |
| Waterford (Brook Lodge).....         | <i>Waterford</i> .....       | 52 15      | 7 7                  | 104                            | 3'13                           | '18          |
| Nenagh (Castle Lough).....           | <i>Tipperary</i> .....       | 52 54      | 8 24                 | 120                            | 3'02                           | '78          |
| Ennistymon House.....                | <i>Clare</i> .....           | 52 57      | 9 18                 | 37                             | 3'57                           | 1'38         |
| Gorey (Courtown House).....          | <i>Wexford</i> .....         | 52 40      | 6 13                 | 80                             | 2'90                           | '32          |
| Abbey Leix (Blandsfort).....         | <i>Queen's County</i> .....  | 52 56      | 7 17                 | 532                            | 2'99                           | '93          |
| Dublin (Fitz William Square).....    | <i>Dublin</i> .....          | 53 21      | 6 14                 | 54                             | 2'60                           | '63          |
| Mullingar (Belvedere).....           | <i>Westmeath</i> .....       | 53 29      | 7 22                 | 367                            | 3'16                           | 1'33         |
| Crossmolina (Enniscoe).....          | <i>Mayo</i> .....            | 54 4       | 9 16                 | 74                             | 3'26                           | 1'50         |
| Cong (The Glebe).....                | „.....                       | 53 33      | 9 16                 | 112                            | 3'72                           | '82          |
| Collooney (Markree Obsy.).....       | <i>Sligo</i> .....           | 54 11      | 8 27                 | 127                            | 3'36                           | 1'63         |
| Seaforde.....                        | <i>Down</i> .....            | 54 19      | 5 50                 | 180                            | 3'32                           | 1'45         |
| Bushmills (Dundarave).....           | <i>Antrim</i> .....          | 55 12      | 6 30                 | 162                            | 3'28                           | 1'52         |
| Omagh (Edenfel).....                 | <i>Tyrone</i> .....          | 54 36      | 7 18                 | 280                            | 3'34                           | 1'64         |

RAINFALL TABLE FOR JULY, 1913—*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. | 1913.                 | Diff. from Aver. in. | % of Av. | in. |                        |                 |
|                          |          | in.               | Date.       |                  | in.                   | in.                  |          |     |                        |                 |
| — .26                    | 90       | .56               | 14          | 12               | 13.53                 | 12.98                | — .55    | 96  | 25.11                  | Camden Square   |
| — .57                    | 74       | .41               | 6           | 14               | 13.65                 | 14.06                | + .41    | 103 | 27.64                  | Tenterden       |
| + .01                    | 100      | .52               | 10          | 13               | 14.92                 | 19.79                | +4.87    | 133 | 30.48                  | Patching        |
| —1.26                    | 48       | .40               | 6           | 12               | 15.75                 | 17.79                | +2.06    | 113 | 31.87                  | Cadland         |
| —1.63                    | 33       | .17               | 15          | 13               | 13.03                 | 12.19                | — .84    | 94  | 24.58                  | Oxford          |
| —1.25                    | 51       | .41               | 10          | 13               | 13.68                 | 12.91                | — .77    | 94  | 25.17                  | Croyland Abbey  |
| + .82                    | 147      | .80               | 7           | 14               | 9.73                  | 10.51                | + .78    | 108 | 19.28                  | Shoeburyness    |
| —1.52                    | 43       | .26               | 14          | 13               | 13.44                 | 12.23                | —1.21    | 91  | 25.40                  | Westley         |
| + .68                    | 129      | 1.49              | 14          | 14               | 11.98                 | 12.38                | + .40    | 103 | 23.73                  | Geldeston       |
| —2.26                    | 18       | .14               | 9           | 9                | 18.62                 | 24.46                | +5.84    | 131 | 38.27                  | Polapit Tamar   |
| —2.41                    | 10       | .11               | 22          | 6                | 17.01                 | 17.73                | + .72    | 104 | 33.54                  | Rousdon         |
| —1.77                    | 36       | .21               | 6           | 9                | 15.83                 | 17.85                | +2.02    | 113 | 29.81                  | Stroud          |
| —1.67                    | 35       | .35               | 6           | 11               | 16.88                 | 22.32                | +5.44    | 132 | 32.41                  | Wolstaston      |
| —1.78                    | 32       | .33               | 5           | 8                | 15.35                 | 16.87                | +1.52    | 110 | 28.98                  | Coventry        |
| —1.56                    | 34       | .23               | 10          | 11               | 12.21                 | 11.57                | — .64    | 95  | 23.35                  | Boston          |
| —1.36                    | 42       | .38               | 6           | 8                | 13.15                 | 12.12                | —1.03    | 92  | 24.46                  | Hodsock Priory  |
| —1.85                    | 46       | .57               | 6           | 13               | 18.17                 | 20.15                | +1.98    | 111 | 34.73                  | Macclesfield    |
| —1.59                    | 46       | .55               | 6           | 14               | 15.88                 | 17.10                | +1.22    | 108 | 32.70                  | Southport       |
| —3.85                    | 19       | .28               | 6           | 8                | 31.97                 | 37.11                | +5.14    | 116 | 61.49                  | Arncliffe       |
| —1.39                    | 46       | .57               | 7           | 9                | 14.19                 | 13.21                | — .98    | 93  | 26.87                  | Ribston Hall    |
| —1.96                    | 18       | .14               | 5           | 10               | 13.47                 | 12.12                | —1.35    | 90  | 26.42                  | Hull            |
| —2.43                    | 16       | .19               | 6           | 10               | 14.45                 | 14.95                | + .50    | 103 | 27.94                  | Newcastle       |
| —7.16                    | 20       | .60               | 6           | 14               | 65.29                 | 77.30                | +12.01   | 118 | 129.48                 | Seathwaite      |
| —2.75                    | 16       | .13               | 21          | 12               | 20.48                 | 26.44                | +5.96    | 129 | 42.28                  | Cardiff         |
| —2.65                    | 22       | .30               | 14          | 9                | 22.84                 | 28.64                | +5.80    | 125 | 46.81                  | Haverfordwest   |
| —1.23                    | 69       | .88               | 17          | 14               | 22.15                 | 34.00                | +11.85   | 154 | 45.46                  | Gogerddan       |
| — .85                    | 66       | .42               | 21          | 13               | 14.89                 | 17.76                | +2.87    | 119 | 30.36                  | Llandudno       |
| —2.57                    | 20       | .28               | 6           | 8                | 22.26                 | 29.67                | +7.41    | 133 | 43.47                  | Cargen          |
| —2.51                    | 24       | .24               | 3           | 9                | 17.68                 | 16.20                | —1.48    | 92  | 33.76                  | Marchmont       |
| —2.98                    | 20       | .22               | 17, 21      | 12               | 24.83                 | 25.20                | + .37    | 101 | 49.77                  | Girvan          |
| —1.49                    | 49       | .47               | 6           | 8                | 18.42                 | 21.40                | +2.98    | 116 | 35.97                  | Glasgow         |
| —3.22                    | 32       | .39               | 16          | 15               | 34.04                 | 39.28                | +5.24    | 115 | 68.67                  | Inveraray       |
| —3.16                    | 23       | .26               | 16          | 16               | 27.67                 | 30.04                | +2.37    | 109 | 56.57                  | Quinish         |
| —2.24                    | 21       | .23               | 6           | 6                | 14.86                 | 15.05                | + .19    | 101 | 28.64                  | Dundee          |
| —2.38                    | 10       | .13               | 5           | 5                | 17.80                 | 20.93                | +3.13    | 118 | 34.93                  | Braemar         |
| —2.31                    | 23       | .30               | 5           | 9                | 17.02                 | 16.39                | — .63    | 96  | 32.73                  | Aberdeen        |
| —2.05                    | 35       | .50               | 6           | 7                | 15.65                 | 12.35                | —3.30    | 79  | 29.33                  | Cawdor          |
| —1.59                    | 47       | .47               | 6           | 8                | 23.20                 | 25.87                | +2.67    | 112 | 44.53                  | Fort Augustus   |
| —3.99                    | 25       | .27               | 13          | 9                | 42.90                 | 45.83                | +2.93    | 107 | 83.93                  | Bendarnagh      |
| —1.59                    | 45       | 1.07              | 13          | 4                | 17.19                 | 12.94                | —4.25    | 75  | 31.90                  | Dunrobin Castle |
| —1.72                    | 36       | .15               | 9           | 14               | 15.38                 | 11.76                | —3.62    | 76  | 29.88                  | Wick            |
| —2.78                    | 21       | .40               | 8           | 15               | 28.40                 | 33.06                | +4.66    | 116 | 54.81                  | Killarney       |
| —2.95                    | 6        | .09               | 8           | 5                | 20.53                 | 24.28                | +3.75    | 118 | 39.57                  | Waterford       |
| —2.24                    | 26       | .31               | 8           | 10               | 20.53                 | 25.91                | +5.38    | 126 | 39.43                  | Castle Lough    |
| —2.19                    | 39       | .54               | 8           | 12               | 23.24                 | 27.50                | +4.26    | 118 | 46.52                  | Ennistymon      |
| —2.58                    | 11       | .15               | 18          | 7                | 18.32                 | 19.97                | +1.65    | 109 | 34.99                  | Courtown Ho.    |
| —2.06                    | 31       | .22               | 18          | 13               | 18.83                 | 24.78                | +5.95    | 132 | 35.92                  | Abbey Leix      |
| —1.97                    | 24       | .16               | 18          | 13               | 14.75                 | 15.73                | + .98    | 107 | 27.68                  | Dublin          |
| —1.83                    | 42       | .26               | 12, 18      | 12               | 19.17                 | 23.92                | +4.75    | 125 | 36.15                  | Mullingar       |
| —1.76                    | 46       | .27               | 8           | 19               | 26.64                 | 34.57                | +7.93    | 130 | 52.87                  | Enniscoe        |
| —2.90                    | 22       | .42               | 8           | 7                | 25.13                 | 31.95                | +6.82    | 127 | 48.90                  | Cong            |
| —1.73                    | 49       | .37               | 8, 18       | 12               | 22.19                 | 27.52                | +5.33    | 124 | 42.71                  | Markree         |
| —1.87                    | 44       | .54               | 21          | 11               | 20.74                 | 21.76                | +1.02    | 105 | 38.91                  | Seaforde        |
| —1.76                    | 46       | .50               | 21          | 9                | 18.77                 | 16.61                | —2.16    | 89  | 37.56                  | Dundarave       |
| —1.70                    | 49       | .26               | 8           | 14               | 20.44                 | 24.71                | +4.27    | 121 | 39.38                  | Omagh           |



## SUPPLEMENTARY RAINFALL, JULY, 1913.

| Div.  | STATION.                      | Rain<br>inches | Div.   | STATION.                      | Rain<br>inches. |
|-------|-------------------------------|----------------|--------|-------------------------------|-----------------|
| II.   | Warlingham, Redvers Road..    | 1·93           | XI.    | Lligwy .....                  | 1·11            |
| „     | Ramsgate .....                | 1·90           | „      | Douglas .....                 | 1·35            |
| „     | Hailsham .....                | 2·95           | XII.   | Stoneykirk, Ardwell House...  | ·59             |
| „     | Totland Bay, Aston House...   | ·72            | „      | Dalry, The Old Garroch.....   | ·91             |
| „     | Stockbridge, Ashley.....      | 1·45           | „      | Beattock, Kinnelhead .....    | ·88             |
| „     | Grayshott .....               | 2·73           | „      | Langholm, Drove Road .....    | 1·08            |
| „     | Caversham, Rectory Road ...   | ·94            | XIII.  | Meggat Water, Cramilt Lodge   | ·80             |
| III.  | Harrow Weald, Hill House...   | 1·88           | „      | North Berwick Reservoir.....  | ·43             |
| „     | Pitsford, Sedgebrook.....     | 1·32           | „      | Edinburgh, Royal Observaty.   | ·46             |
| „     | Woburn, Milton Bryant.....    | 1·39           | XIV.   | Maybole, Knockdon Farm ...    | ·68             |
| „     | Chatteris, The Priory.....    | ·77            | XV.    | Ballachulish House .....      | 1·48            |
| IV.   | Colchester, Hill Ho., Lexden  | 1·48           | „      | Campbeltown, Witchburn ..     | 1·38            |
| „     | Newport, Belmont House ...    | 1·71           | „      | Holy Loch, Ardnadam.....      | 1·37            |
| „     | Ipswich, Rookwood, Copdock    | 2·31           | „      | Islay, Eallabus .....         | 1·32            |
| „     | Blakeney .....                | ·78            | „      | Tiree, Cornaigmore .....      | 1·37            |
| „     | Swaffham .....                | ·75            | XVI.   | Dollar Academy .....          | ·83             |
| V.    | Bishops Cannings .....        | 2·10           | „      | Balquhider, Stronvar.....     | ·50             |
| „     | Winterbourne Steepleton.....  | ...            | „      | Glenlyon, Meggernie Castle..  | ·70             |
| „     | Ashburton, Druid House.....   | ·48            | „      | Blair Atholl .....            | ·43             |
| „     | Cullompton .....              | ·68            | „      | Coupar Angus .....            | ·42             |
| „     | Lynmouth, Rock House .....    | ·55            | „      | Montrose, Sunnyside Asylum.   | 1·27            |
| „     | Okehampton, Oaklands.....     | ·79            | XVII.  | Alford, Lynturk Manse .....   | ·80             |
| „     | Hartland Abbey .....          | ·54            | „      | Fyvie Castle .....            | 1·00            |
| „     | Probus, Lamellyn.....         | ·47            | „      | Keith Station .....           | 1·05            |
| „     | North Cadbury Rectory.....    | 1·27           | XVIII. | Alvey Manse.....              | 1·19            |
| VI.   | Clifton, Pembroke Road.....   | ·55            | „      | Loch Quoich, Loan .....       | 3·20            |
| „     | Ross, The Graig .....         | ·73            | „      | Drumnadrochit .....           | 1·78            |
| „     | Shifnal, Hatton Grange.....   | 1·40           | „      | Skye, Dunvegan .....          | 1·14            |
| „     | Droitwich .....               | 1·20           | „      | N. Uist, Lochmaddy .....      | ...             |
| „     | Blockley, Upton Wold.....     | 1·81           | „      | Glencarron Lodge .....        | 1·85            |
| VII.  | Market Overton.....           | 1·46           | XIX.   | Invershin .....               | 1·92            |
| „     | Market Rasen .....            | ·31            | „      | Melvich .....                 | 1·21            |
| „     | Bawtry, Hesley Hall .....     | ·57            | „      | Loch Stack, Ardchullin .....  | 2·77            |
| „     | Derby, Midland Railway.....   | ·90            | XX.    | Skibbereen Rectory .....      | ·36             |
| „     | Buxton .....                  | 1·39           | „      | Dunmanway, The Rectory ..     | ·31             |
| VIII. | Nantwich, Dorfold Hall .....  | 1·01           | „      | Glanmire, Lota Lodge, No. 1   | ·25             |
| „     | Chatburn, Middlewood .....    | 1·44           | „      | Mitchelstown Castle.....      | ·58             |
| „     | Cartmel, Flookburgh .....     | 1·04           | „      | Darrynane Abbey.....          | 1·74            |
| IX.   | Langsett Moor, Up. Midhope    | 1·49           | „      | Clonmel, Bruce Villa .....    | ·42             |
| „     | Scarborough, Scalby .....     | ·87            | „      | Newmarket-on-Fergus, Fenloe   | 1·09            |
| „     | Ingleby Greenhow .....        | 1·18           | XXI.   | Laragh, Glendalough .....     | ·42             |
| „     | Mickleton .....               | 1·18           | „      | Ballycumber, Moorock Lodge    | ·81             |
| X.    | Bellingham, High Green Manor  | ·97            | „      | Balbriggan, Ardgillan .....   | 1·16            |
| „     | Ilderton, Lilburn Cottage ... | 1·08           | XXII.  | Woodlawn .....                | 1·10            |
| „     | Keswick, The Bank.....        | ·93            | „      | Westport, St. Helens .....    | 1·29            |
| XI.   | Llanfrecfa Grange .....       | ·60            | „      | Dugort, Slievemore Hotel ...  | 2·69            |
| „     | Treherbert, Tyn-y-waun .....  | ·86            | „      | Nohill Rectory .....          | 1·69            |
| „     | Carmarthen, The Friary .....  | ·97            | XXIII. | Enniskillen, Portora.....     | 1·50            |
| „     | Castle Malgwyn [Llechryd]...  | ·80            | „      | Dartrey [Cootehill] .....     | 1·75            |
| „     | Crickhowell, Tal-y-maes ..... | 1·30           | „      | Warrenpoint, Manor House ..   | 1·34            |
| „     | New Radnor, Ednol .....       | ·88            | „      | Banbridge, Milltown .....     | 1·66            |
| „     | Birmingham WW., Tyrmynydd     | 1·34           | „      | Belfast, Cave Hill Road ..... | 1·76            |
| „     | Lake Vyrnwy .....             | ...            | „      | Glenarm Castle.....           | ·80             |
| „     | Llangyhanfal, Pläs Draw.....  | 1·50           | „      | Londonderry, Creggan Res...   | 2·56            |
| „     | Dolgelly, Bryntirion.....     | 2·34           | „      | Dunfanaghy, Horn Head ...     | 1·92            |
| „     | Bettws-y-Coed, Tyn-y-bryn...  | 1·27           | „      | Killybegs .....               | 2·41            |

## METEOROLOGICAL NOTES ON JULY, 1913.

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.—Though only one day was entirely sunless, the weather was generally dull and unusually cool. R fell frequently in the first half of the month, but only on 3 days after the 15th, and the last 10 days were all rainless. Mean temp.  $60^{\circ}\cdot 2$  or  $3^{\circ}\cdot 3$  below the average. Duration of sunshine  $100\cdot 6^*$  hours, and of R  $35\cdot 4$  hours. Evaporation  $2\cdot 15$  in. Shade max.  $78^{\circ}\cdot 9$  on 28th; min.  $44^{\circ}\cdot 3$  on 8th. F 0, f 0.

TENTERDEN.—A dull month with only  $127\cdot 5^*$  hours of sunshine and only 5 days with temp. above  $70^{\circ}$ . Shade max.  $73^{\circ}\cdot 5$  on 31st; min.  $40^{\circ}\cdot 5$  on 8th. F 0, f 0.

TOTLAND BAY.—Duration of sunshine  $161\cdot 1^*$  hours, or  $84\cdot 2$  hours below the average, and the least ever recorded here in July. Shade max.  $73^{\circ}\cdot 8$  on 31st; min.  $50^{\circ}\cdot 0$  on 8th. F 0, f 0.

MILTON BRYANT.—A dull July, hindering haymaking but helpful to the corn. Shade max.  $83^{\circ}\cdot 0$  on 12th and 29th; min.  $42^{\circ}\cdot 0$  on 7th, 8th and 9th.

IPSWICH, COPDOCK.—A dismal and depressing month though not unfavourable to agriculture. Temp. reached  $70^{\circ}$  on only 3 days. Duration of sunshine  $114\cdot 1^*$  hours. Mean temp.  $57^{\circ}\cdot 2$ . Shade max.  $71^{\circ}\cdot 0$  on 14th; min.  $40^{\circ}\cdot 0$  on 8th. F 0, f 0.

POLAPIT, TAMAR.—Very dry month with night temp. low on the whole. Shade max.  $77^{\circ}\cdot 6$  on 29th; min.  $43^{\circ}\cdot 1$  on 21st. F 0, f 0.

NORTH CADBURY.—Many small falls and provoking drizzles, especially from 15th to 22nd, hindering haymaking. Last 9 days fine and pleasant. Temp. much below average. Shade max.  $83^{\circ}\cdot 0$  on 28th; min.  $46^{\circ}\cdot 0$  on 9th. F 0, f 0.

HODSOCK PRIORY.—Dry and cool and the dulllest July since 1888. Shade max.  $78^{\circ}\cdot 1$  on 29th; min.  $42^{\circ}\cdot 5$  on 9th. F 0, f 0.

SOUTHPORT.—Duration of sunshine  $186\cdot 4^*$  hours or  $29\cdot 0$  hours below the average. Duration of R  $33\cdot 1$  hours. Mean temp.  $58^{\circ}\cdot 2$ . Evaporation  $3\cdot 11$  in. Shade max.  $73^{\circ}\cdot 0$  on 30th; min.  $46^{\circ}\cdot 0$  on 7th. F 0, f 0.

HULL.—Fine and dry but with a great amount of cloud and only  $63\cdot 0^*$  hours of sunshine. A fresh gale did damage to trees and property on 23rd. Shade max.  $75^{\circ}\cdot 0$  on 13th; min.  $45^{\circ}\cdot 0$  on 8th. F 0, f 0.

CARMARTHEN.—The finest and driest July for many years. An excellent hay harvest but water supplies running low.

LLANDUDNO.—Shade max.  $71^{\circ}\cdot 0$  on 30th; min.  $48^{\circ}\cdot 0$  on 7th.

MARCHMONT.—Duration of sunshine  $138\cdot 6$  hours on 28 days.

EDINBURGH.—The driest July since the record began in 1896. Shade max.  $74^{\circ}\cdot 4$  on 2nd; min.  $42^{\circ}\cdot 2$  on 7th. F 0, f 0.

ARDNADAM.—The first half of month was normal, the latter half very fine. No R after 21st and water supply running short. Shade max.  $73^{\circ}\cdot 4$  on 27th; min.  $40^{\circ}\cdot 4$  on 8th. F 0, f 0.

COUPAR ANGUS.—R fell sparingly on only 5 days and crops are suffering for want of R. There was much sunshine but an absence of any spell of excessive heat.

LOCH STACK.—Duration of sunshine  $116\cdot 9^*$  hours.

WATERFORD.—The driest July for at least 64 years. Light E. winds.

DUBLIN.—The smallest July R since 1870. Mean temp. equal to the average. Shade max.  $72^{\circ}\cdot 0$  on 2nd; min.  $44^{\circ}\cdot 1$  on 8th. F 0, f 0.

MARKREE.—Slight R fell in the first part of the month, but on the whole the weather was fair generally.

BELFAST.—Beautiful summer weather after 21st, without oppressive heat.

\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, February, 1913.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |        |          |        | Average. |       |               |           | Absolute.       |                   | Total Rain |       | Aver.<br>Cloud. |
|------------------------------------------------------------------|-----------|--------|----------|--------|----------|-------|---------------|-----------|-----------------|-------------------|------------|-------|-----------------|
|                                                                  | 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                                            | 55° 1     | 4      | 24° 1    | 23     | 46° 9    | 35° 3 | 36° 7         | 85        | 90° 0           | 21° 0             | ·79        | 12    | 8 0             |
| Malta ... ..                                                     | 63° 5     | 2      | 40° 4    | 14     | 58° 0    | 50° 1 | ...           | 82        | 128° 2          | ..                | 3° 20      | 15    | 6 1             |
| Lagos ... ..                                                     | 92° 0     | 6, 14  | 71° 0    | 15     | 89° 1    | 75° 9 | 73° 7         | 72        | 152° 2          | 69° 2             | 2° 98      | 7     | 5 6             |
| Cape Town ... ..                                                 | 95° 1     | 4      | 56° 2    | 17     | 80° 4    | 63° 5 | 60° 9         | 71        | ...             | ...               | ·84        | 6     | 3 3             |
| Natal, Durban ... ..                                             | 84° 2     | 2      | 66° 2    | 26     | 80° 7    | 70° 2 | 71° 7         | 83        | ...             | ...               | 4° 60      | 10    | 4 9             |
| Johannesburg ... ..                                              | 81° 8     | 27     | 50° 2    | 21     | 76° 0    | 55° 8 | 53° 9         | 79        | 155° 8          | 49° 9             | 3° 08      | 15    | 4 7             |
| Mauritius ... ..                                                 | 86° 9     | 6      | 66° 6    | 3      | 84° 2    | 73° 2 | 72° 0         | 82        | 157° 0          | 61° 9             | 5° 63      | 21    | 6 7             |
| Bloemfontein ... ..                                              | 89° 9     | 1      | 54° 5    | 24     | 80° 9    | 60° 2 | 60° 2         | 78        | ...             | ...               | 4° 82      | 11    | 4 3             |
| Calcutta... ..                                                   | 88° 8     | 23     | 54° 7    | 6      | 81° 4    | 62° 3 | 62° 5         | 74        | ...             | 48° 0             | 3° 29      | 4     | 3 1             |
| Bombay... ..                                                     | 87° 4     | 23     | 63° 3    | 26     | 84° 1    | 69° 7 | 65° 1         | 69        | 124° 8          | 56° 9             | ·00        | 0     | 0 8             |
| Madras ... ..                                                    | 89° 3     | 24     | 64° 6    | 10     | 87° 0    | 71° 2 | 70° 3         | 77        | 138° 9          | 61° 9             | ·00        | 0     | 2 7             |
| Kodaikanal ... ..                                                | 73° 7     | 23, 24 | 40° 6    | 5      | 68° 2    | 47° 0 | 43° 4         | 64        | 146° 6          | 29° 0             | 1° 07      | 5     | 3 7             |
| Colombo, Ceylon ... ..                                           | 90° 1     | 3, 21  | 66° 3    | 9      | 88° 2    | 71° 6 | 72° 2         | 79        | 157° 0          | 58° 0             | 2° 26      | 8     | 4 3             |
| Hongkong ... ..                                                  | 73° 9     | 19     | 50° 8    | 26     | 64° 6    | 57° 3 | 54° 9         | 81        | ...             | ...               | 2° 39      | 6     | 6 8             |
| Sydney ... ..                                                    | 100° 5    | 18     | 60° 9    | 13     | 80° 5    | 66° 5 | 60° 8         | 65        | 154° 9          | 53° 0             | 1° 30      | 16    | 4 7             |
| Melbourne ... ..                                                 | 105° 3    | 4      | 47° 2    | 21     | 78° 9    | 58° 3 | 52° 5         | 55        | 155° 2          | 42° 1             | 1° 19      | 4     | 4 9             |
| Adelaide ... ..                                                  | 104° 8    | 25     | 52° 8    | 2      | 84° 8    | 61° 8 | 54° 2         | 50        | 166° 4          | 44° 4             | 2° 56      | 6     | ...             |
| Perth ... ..                                                     | 99° 9     | 12     | 49° 0    | 1      | 86° 3    | 63° 4 | 56° 2         | 53        | 166° 0          | 40° 9             | ·00        | 0     | 2 2             |
| Coolgardie ... ..                                                | 108° 2    | 24     | 52° 0    | 5      | 93° 6    | 62° 3 | 53° 8         | 41        | 174° 0          | 49° 8             | ·00        | 0     | 2 3             |
| Hobart, Tasmania ... ..                                          | 92° 6     | 24     | 46° 3    | 21     | 71° 2    | 52° 8 | 47° 3         | 56        | 154° 8          | 39° 4             | ·31        | 7     | 5 4             |
| Wellington ... ..                                                | 78° 2     | 20     | 47° 8    | 24     | 68° 4    | 56° 7 | 52° 8         | 71        | 140° 2          | 83° 6             | 1° 71      | 8     | 6 5             |
| Auckland ... ..                                                  | 79° 0     | 12     | 52° 0    | 24     | 72° 1    | 58° 7 | 57° 7         | 77        | 145° 0          | 48° 0             | 1° 38      | 9     | 5 9             |
| Jamaica, Kingston ... ..                                         | 89° 3     | 6      | 61° 1    | 14     | 86° 0    | 67° 2 | 65° 9         | 77        | ...             | ...               | ·06        | 2     | 3 8             |
| Grenada ... ..                                                   | 83° 0     | ser.   | 69° 0    | 15, 18 | 81° 4    | 71° 2 | ...           | 73        | 139° 0          | ...               | 3° 26      | 16    | 2 4             |
| Toronto ... ..                                                   | 53° 2     | 20     | —1° 4    | 10     | 28° 0    | 12° 7 | 13° 0         | 81        | ...             | —4° 5             | 1° 14      | 12    | 5 1             |
| Fredericton ... ..                                               | 37° 5     | 21     | —20° 0   | 25     | 21° 7    | 1° 8  | ...           | 82        | ...             | ...               | 2° 87      | 13    | 4 6             |
| St. John, N.B. ... ..                                            | 46° 2     | 1      | —10° 7   | 10     | 23° 9    | 8° 3  | ...           | 70        | ...             | ...               | 2° 69      | 11    | 4 8             |
| Edmonton, Alberta ... ..                                         | 50° 0     | 15     | —33° 0   | 3      | 22° 9    | 4° 7  | ...           | 79        | 96° 6           | —37° 2            | ·39        | 10    | 6 7             |
| Victoria, B.C. ... ..                                            | 50° 5     | 16     | 27° 0    | 25     | 44° 0    | 32° 8 | 33° 0         | 81        | ...             | ...               | 1° 91      | 8     | 5 9             |

MALTA.—Mean temp. of air 54°·1. Average daily sunshine 5·4 hours.

Johannesburg.—Bright sunshine 221·8 hours.

Mauritius.—Mean temp. of air 0°·5 and R 1·34 in. below averages. Mean hourly velocity of wind 10·7 miles or 0·3 miles below average.

KODAIKANAL.—Bright sunshine 227 hours.

COLOMBO.—Mean temp. of air 79°·9 or 0°·2 below, of dew point 1°·8 above, and R ·78 in. above, averages. Mean velocity of wind 4·2 miles per hour. TSS on 9 days.

HONGKONG.—Mean temp. of air 60°·5. Mean hourly velocity of wind 13·1 miles. Bright sunshine 107·7 hours.

Sydney.—R 3·38 in. below, temp. of air 2°·4 above, averages.

Melbourne.—Mean temp. of air 1°·3 above, and R ·55 in. below, averages.

Adelaide.—Mean temp. of air 0°·7 below, and R 1·96 in. above, averages. With one exception the heaviest R in 74 years; 1·88 in. fell in 45 minutes on the 13th.

Perth.—R ·32 in. below, and temp. 0°·6 above, averages.

Hobart.—Mean temp. of air 0°·6 below, and R 1·16 in. below, averages.

Wellington.—R 1·62 in. below average. Bright sunshine 219·4 hours.

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## THE SUMMERS OF 1912 AND 1913.

THE contrast between the rainfall of the summers of 1912 and 1913 was remarkable over the whole of the British Isles. The table on page 138 gives the totals, with their relation to the average, for the three months June to August in each year. The stations are evenly distributed over the British Isles so that the mean value represents the country with a fair degree of accuracy. In 1912 about half the area of the British Isles received more than 50 per cent. in excess of the average for the three months; only a part of the west of Scotland had less than the average, whilst in many parts of England the excess was more than 100 per cent. For the same period in 1913 nearly half the area of the British Isles had a deficiency of 50 per cent. and only on the extreme south-east was the average exceeded. The latter was probably entirely the effect of the heavy rain on the south coast at the end of August.

The positions of the relatively wet and dry areas for 1913 are almost the reverse of those for 1912. For example, the mean percentage of the average for the three months in 1912 was 148 and this was exceeded in the south and east of Ireland and in England, except the north-west and lower Thames valley. The mean percentage of the average for the same period in 1913 was 55, and the areas with less than 55 per cent. in 1913 correspond roughly with those with more than 148 per cent. in 1912. The following summary shows for each of the great divisions the striking nature of the contrast between the two summers:—

### *Rainfall June to August as Percentage of Average.*

|           | England. | Wales. | Scotland. | Ireland. | British Isles. |
|-----------|----------|--------|-----------|----------|----------------|
| 1912..... | 166      | 179    | 114       | 145      | 148            |
| 1913..... | 51       | 68     | 57        | 53       | 55             |

In reviewing *British Rainfall*, 1912, *The Times* (and later, by what we may perhaps term a retarded coincidence, the *Irish Times* in identical words) found fault with that volume and with Meteorologists in general for not producing comprehensive generalisations. We find it no easy matter to avoid hasty generalisations such as the foregoing figures suggest that a wet summer is followed by a dry summer, but we feel sure that only by securing accurate data over wide areas can we hope ultimately to arrive at a sound theoretical meteorology. Signs are not wanting that this will be attained in due time, but that time will not be hastened by premature attempts to leap further than we can look.

|                     | Aver.<br>June-<br>Aug. | June-<br>Aug.,<br>1912. | Diff.  | Per<br>cent. | June-<br>Aug.,<br>1913. | Diff. | Per<br>cent. | June-Aug.<br>1913,<br>diff. from<br>1912. |
|---------------------|------------------------|-------------------------|--------|--------------|-------------------------|-------|--------------|-------------------------------------------|
|                     | in.                    | in.                     | in.    |              | in.                     | in.   |              | in.                                       |
| Camden Square ...   | 7·24                   | 9·56                    | + 2·32 | 132          | 4·32                    | -2·92 | 60           | - 5·24                                    |
| Tenterden .....     | 6·66                   | 10·58                   | + 3·92 | 159          | 3·63                    | -3·03 | 55           | - 6·95                                    |
| Patching .....      | 7·11                   | 13·06                   | + 5·95 | 184          | 7·64                    | + ·53 | 107          | - 5·42                                    |
| Oxford .....        | 7·14                   | 10·76                   | + 3·62 | 151          | 2·02                    | -5·12 | 28           | - 8·74                                    |
| Wellingborough ...  | 7·02                   | 13·75                   | + 6·73 | 196          | 3·65                    | -3·37 | 52           | -10·10                                    |
| Shoeburyness .....  | 5·24                   | 6·54                    | + 1·30 | 125          | 3·07                    | -2·17 | 59           | - 3·47                                    |
| Westley .....       | 7·41                   | 13·32                   | + 5·91 | 180          | 4·21                    | -3·20 | 57           | - 9·11                                    |
| Polapit Tamar ..... | 8·09                   | 17·86                   | + 9·77 | 221          | 3·09                    | -5·00 | 38           | -14·77                                    |
| Rousdon .....       | 7·70                   | 13·45                   | + 5·75 | 175          | 2·33                    | -5·37 | 30           | -11·12                                    |
| Stroud .....        | 8·08                   | 19·53                   | +11·45 | 242          | 2·97                    | -5·11 | 37           | -16·56                                    |
| Wolstaston .....    | 8·60                   | 14·35                   | + 5·75 | 167          | 3·64                    | -4·96 | 42           | -10·71                                    |
| Coventry .....      | 7·93                   | 14·39                   | + 6·46 | 181          | 2·08                    | -5·85 | 26           | -12·31                                    |
| Boston .....        | 6·69                   | 13·77                   | + 7·08 | 206          | 2·71                    | -3·98 | 41           | -11·06                                    |
| Hodsock Priory ...  | 6·96                   | 14·13                   | + 7·17 | 203          | 3·02                    | -3·94 | 43           | -11·11                                    |
| Macclesfield .....  | 10·02                  | 14·34                   | + 4·32 | 143          | 6·49                    | -3·53 | 65           | -17·85                                    |
| Southport .....     | 8·91                   | 13·75                   | + 4·84 | 154          | 4·92                    | -3·99 | 55           | - 8·83                                    |
| Arncliffe .....     | 14·00                  | 20·10                   | + 6·10 | 144          | 5·65                    | -8·35 | 40           | -14·45                                    |
| Ribston Hall .....  | 7·51                   | 14·21                   | + 6·70 | 189          | 3·68                    | -3·83 | 49           | -10·53                                    |
| Hull .....          | 7·53                   | 13·23                   | + 5·70 | 176          | 1·99                    | -5·54 | 26           | -11·24                                    |
| Newcastle .....     | 8·14                   | 12·84                   | + 4·70 | 158          | 3·01                    | -5·13 | 37           | - 9·83                                    |
| Seathwaite .....    | 27·32                  | 33·89                   | + 6·57 | 124          | 20·77                   | -6·55 | 76           | -13·12                                    |
| Cardiff .....       | 10·35                  | 20·91                   | +10·56 | 202          | 4·28                    | -6·07 | 41           | -16·63                                    |
| Haverfordwest ...   | 10·34                  | 17·96                   | + 7·62 | 174          | 5·03                    | -5·31 | 49           | -12·93                                    |
| Gogerddan .....     | 11·88                  | 19·99                   | + 8·11 | 168          | 11·29                   | - ·59 | 95           | - 8·70                                    |
| Llandudno .....     | 7·65                   | 13·14                   | + 5·49 | 172          | 6·56                    | -1·09 | 86           | - 6·58                                    |
| Cargen .....        | 10·27                  | 18·19                   | + 7·92 | 177          | 5·44                    | -4·83 | 53           | -12·75                                    |
| Marchmont .....     | 9·22                   | 11·15                   | + 1·93 | 121          | 5·15                    | -4·07 | 56           | - 6·00                                    |
| Girvan .....        | 11·31                  | 12·59                   | + 1·28 | 111          | 5·58                    | -5·73 | 49           | - 7·01                                    |
| Inveraray .....     | 14·38                  | 12·56                   | - 1·82 | 87           | 10·38                   | -4·00 | 72           | - 2·18                                    |
| Quinish .....       | 12·42                  | 13·44                   | + 1·02 | 108          | 5·87                    | -6·55 | 47           | - 7·57                                    |
| Dundee .....        | 8·24                   | 9·58                    | + 1·34 | 116          | 3·24                    | -5·00 | 39           | - 6·34                                    |
| Braemar .....       | 8·46                   | 9·55                    | + 1·09 | 113          | 2·90                    | -5·56 | 34           | - 6·65                                    |
| Aberdeen .....      | 8·09                   | 9·62                    | + 1·53 | 119          | 3·42                    | -4·67 | 42           | - 6·20                                    |
| Fort Augustus ..... | 8·57                   | 9·60                    | + 1·03 | 112          | 6·32                    | -2·25 | 74           | - 3·28                                    |
| Bendamph .....      | 16·03                  | 13·75                   | - 2·28 | 86           | 11·43                   | -4·60 | 71           | - 2·32                                    |
| Dunrobin Castle ... | 7·72                   | 11·37                   | + 3·65 | 147          | 5·71                    | -2·01 | 74           | - 5·66                                    |
| Wick .....          | 7·23                   | 8·06                    | + ·83  | 111          | 4·26                    | -2·97 | 59           | - 3·80                                    |
| Killarney .....     | 11·02                  | 16·48                   | + 5·46 | 150          | 5·98                    | -5·04 | 54           | -10·50                                    |
| Waterford .....     | 9·65                   | 15·86                   | + 6·21 | 164          | 4·61                    | -5·04 | 48           | -11·25                                    |
| Castle Lough .....  | 9·76                   | 13·48                   | + 3·72 | 138          | 5·75                    | -4·01 | 59           | - 7·73                                    |
| Ennistymon .....    | 11·76                  | 14·97                   | + 3·21 | 127          | 7·59                    | -4·17 | 65           | - 7·38                                    |
| Courtown House ...  | 8·80                   | 16·66                   | + 7·86 | 189          | 2·63                    | -6·17 | 30           | -14·03                                    |
| Abbey Leix .....    | 9·51                   | 15·11                   | + 5·60 | 159          | 5·15                    | -4·36 | 54           | - 9·96                                    |
| Dublin .....        | 7·68                   | 10·93                   | + 3·25 | 142          | 2·77                    | -4·91 | 36           | - 8·16                                    |
| Mullingar .....     | 9·88                   | 15·34                   | + 5·46 | 155          | 5·71                    | -4·17 | 58           | - 9·63                                    |
| Enniscoe .....      | 11·11                  | 12·42                   | + 1·31 | 112          | 6·48                    | -4·63 | 58           | - 5·94                                    |
| Cong .....          | 11·60                  | 13·36                   | + 1·76 | 115          | 5·78                    | -5·82 | 50           | - 7·58                                    |
| Markree .....       | 10·77                  | 15·23                   | + 4·46 | 141          | 6·42                    | -4·35 | 60           | - 8·81                                    |
| Seaforde .....      | 9·84                   | 16·38                   | + 6·54 | 166          | 4·19                    | -5·65 | 43           | -12·19                                    |
| Dundarave .....     | 9·90                   | 13·10                   | + 3·20 | 132          | 6·11                    | -3·79 | 62           | - 6·99                                    |
| Omagh .....         | 10·38                  | 15·55                   | + 5·17 | 150          | 6·12                    | -4·26 | 59           | - 9·43                                    |
| Mean .....          | 9·59                   | 14·19                   | + 4·60 | 148          | 5·24                    | -4·35 | 55           | - 8·95                                    |





# THAMES VALLEY RAINFALL — AUGUST, 1913.



ALTITUDE  
SCALE

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

SCALE OF MILES

0 5 10 15 20

## THE WEATHER OF AUGUST.

THE month opened with an increase in the intensity of the anticyclonic system which lay over the British Islands at the close of July, and during the first eight days the general distribution of pressure remained unchanged, with light winds from between north-west and north-east. Mean temperature was below the average in all parts of the country, the greatest deficiency being in the east and south-east of England. On the 3rd, the temperature rose to  $82^{\circ}$  at many places in the north-east of England including Durham, West Witton and York, a similar high reading being at Bawtry on the 3rd. Minima as low as  $35^{\circ}$  occurred on the 8th at Colmonell and Cally in the west of Scotland, and sharp ground frosts (as low as  $27^{\circ}$  at Fulbeck) were recorded in widely separated localities. Over the kingdom generally, very little rain fell, and at some stations there was none. On the 9th, the anticyclone had passed out into the Atlantic, the British Isles being under the influence of a shallow depression which was associated with thunderstorms at Southampton on the 8th, and at several places in the south and east of England on the 9th when an inch of rain fell at Bath. During the week ending the 16th, dull and unsettled weather prevailed over the whole of our islands, temperature agreed closely with the normal, and little rain fell except in the English Channel, where on the 11th, 1.47 in. fell at Scilly, thunderstorms occurring on this day at Nottingham, Folkestone and Cambridge. From the 14th to the 23rd, during which period anticyclonic conditions in general prevailed, a good deal of fog was reported on the western coasts and in the Bay of Biscay. Bright sunshine and rainfall were deficient. By the morning of the 21st, the greater part of the country was under the influence of a somewhat deep depression, central off the west of Iceland, which on this and the following day was associated with heavy rains in the west of Scotland, and the north-west of England and Wales, 2 inches being reported at Poltalloch on the 22nd. Thunderstorms occurred at a few stations on the 23rd, and a gale at Malin Head on the 24th. By the 26th, a short spell of fine weather had set in with a rise of temperature, which on the 28th reached  $82^{\circ}$  at Bath, and  $79^{\circ}$  at Kew. High night minima exceeding  $60^{\circ}$  at many coastal stations were frequent during the last week. On the 28th, a shallow depression covered the Bay of Biscay, Brittany, and the western portion of the Channel, which by the morning of the 30th embraced England, the Netherlands and northern France. On this day thunderstorms passed over Yorkshire, heavy hail fell in and around Leeds, and many houses at Doncaster were struck by lightning. On the last day of the month, a torrential downpour visited the south-eastern and southern coasts, with nearly  $2\frac{1}{2}$  inches of rain at Worthing and close on 3 inches at Folkestone.



## Correspondence.

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

## RAINFALL COMPARISONS.

I THINK the enclosed comparison between the rainfall here for the past three months and the same period last year may be of interest to you.

|              | 1912.     |                  | 1913.     |                  |
|--------------|-----------|------------------|-----------|------------------|
|              | Wet Days. | Rainfall.<br>in. | Wet Days. | Rainfall.<br>in. |
| June .....   | 20        | 6.90             | 12        | 1.85             |
| July .....   | 23        | 4.06             | 9         | .58              |
| August ..... | 28        | 10.77            | 10        | .48              |
|              | <hr/> 71  | <hr/> 21.73      | <hr/> 31  | <hr/> 2.91       |

Of the total for August, .08 in. fell on September 1st between 5 and 6 a.m., so August really only had a total of .40 in.

MABEL FOSTER.

*Lawwithan, Lostwithiel, September 3rd, 1913.*

THE contrast between the summer rainfall of 1912 and 1913 is certainly remarkable.

|            | 1912<br>in. | 1913.<br>in. |
|------------|-------------|--------------|
| June ..... | 4.84        | .41          |
| July ..... | 3.96        | 1.08         |
| August ... | 7.75        | 1.26         |
|            | <hr/> 16.55 | <hr/> 2.75   |

H. C. BOUTFLOWER.

*Hampton, Evesham, Worcestershire, September 2nd, 1913.*

THE rainfall of the past four months, but for the inch which fell on August 30th and 31st, would have been the least in 50 years.

|           | in.  |           | in.  |           | in.  |
|-----------|------|-----------|------|-----------|------|
| 1864..... | 4.79 | 1885..... | 4.62 | 1911..... | 4.06 |
| 1870..... | 4.79 | 1906..... | 4.26 | 1913..... | 4.47 |
| 1884..... | 4.78 |           |      |           |      |

The wet spring, however, together with the dull skies and low temperature of July and August, made the drought very much less severe than in 1911, the contrast in the two years being curiously like that between 1884 and 1885, and grass land has only quite recently begun to turn brown.

J. E. MACE.

*View Tower, Tenderden, September 2nd, 1913.*

### PARTIAL DROUGHT--SUNSETS.

THE partial drought here of 33 days, May 30th to July 1st, inclusive, has been followed by a similar period of 34 days, July 20th to August 22nd, inclusive, with a total rainfall of 32 inches on seven days.

Last year a note was sent on the unusual absence of fine sunsets during most of July and all August. That was traced later to the Aleutian eruption as probable cause. This year there has been from June onwards a very marked contrast, with especial frequency of the suffused delicate rosy glow which was so typical of the post-Krakatoa sunsets. Six such were recorded in June, 7 in July (6 of these in the Ober-harz district of Germany), and 5 in August. It will be interesting should it be shown that these effects are associated with the finer material left behind from the dust-cloud which was responsible for the absence of sunsets and clear heavens last late summer and autumn.

J. E. CLARK.

*Asgarth, Riddlesdown Road, Purley, Surrey, 30th August, 1913.*

### A GREAT DROUGHT.

AN absolute drought from July 9th to August 9th, 31 days, ended with 07 in. of rain on the 9th and 06 in. on the 10th inst. The rain from May 14th to August 9th, 87 days, was 1.23 in. It is 20 years, 1893, since I have anything to equal the above. In the spring of that year we had the following rain in Hampshire: March, 63 in., and April, 04 in. (67 in. in 61 days); May, 78 in. (1.45 in. in 92 days), and June, 81 in., making a total of 2.26 in. in 122 days.

ARTHUR F. PARBURY!

*Mamhead, Kenton, Nr. Exeter, 12th August, 1913.*

### THE CLIMATE OF TORQUAY.

THE Torquay winter climate is given a bad name by Sir John Edwards-Moss (p. 129), who finds it, after six years, "terribly wet, sunless and windy." It may be well to remember that his place is on high ground to the north of the town, near Watcombe; that Torquay has really a variety of climates, according to position; that it has many well-sheltered nooks; that it is considerably warmer near the sea than on high ground at the back; and that, according to official figures, the mean humidity is 79, as against Margate and Folkestone 82, Brighton 83, Falmouth 84, Newquay 86, etc. From experience of last winter, I may say, that while as elsewhere the season was very wet, there was for a Londoner no cold to speak of. And I am inclined to think that, not only from the climatic but various other points of view, there is no more delectable health resort in this island of Britain to pass the winter in.

ALEX. B. MACDOWALL.

*Hollocombe, Rowdens Road, Torquay.*

## RAIN DAYS IN 1913.

THIS district, Blundellsands, which normally boasts of a comparatively light rainfall, can beat the number of rain days in 1913 as given by your correspondent, Mr. John Dover, in your June issue :—

|                            | Wet Days. | Rainfall. |
|----------------------------|-----------|-----------|
| January to May, 1913 ..... | 97 .....  | 12·76 in. |

Last year, although the rainfall for the same period was 11·81 in., the number of rain days was only 71 ; the great difference in the number of rain days here was largely due to the extraordinary drought we experienced in April, 1912, when rain was recorded on only 4 days, as against 20 in April, 1913.

HUGH MONTGOMERY, F.R.Met.Soc.

*"Myra," St. Anthony's Road, Blundellsands, nr. Liverpool.*

## WINTER FLUCTUATIONS OF TEMPERATURE IN ENGLAND AND SCOTLAND.

IN reply to Mr. Single I would say that the fluctuations of temperature are more sudden and rapid in the north because the changes of wind and weather are quicker as one approaches the centre of a low pressure region like the North Atlantic. Mr. Single's suggestion bears rather upon snowfall than fluctuation of temperature ; but concerning the probable causes, in addition to the higher latitude, of the much heavier snowfall in the north of England and Scotland than in the south of England. I shall have something to say at a more appropriate season. Meanwhile let us enjoy the summer.

In connection with the greater instability of weather in north of Scotland than in the south of England, it is interesting to note that the extremes of pressure in winter, the season of greatest range, are much greater in the former regions, so that while its cyclonic minima are deeper in Scotland, as one would expect in a region of lower average pressure, the anticyclonic maxima are higher. Thus at Aberdeen the barometer in winter sometimes exceeds 31 in. and falls below 28, but in London, so far as I am aware it has never once reached 31·0 in. or fallen as low as 28·0.

L. C. W. BONACINA.

*Hampstead, N.W., 25th June, 1913.*

## A HEAVY RAIN IN FRANCE.

THE following notes on a heavy rain in Southern France at the beginning of June may interest your readers.

We left Millau, altitude 1243 ft., at the confluence of the Tarn and Dourbie, on May 30th, and followed the valley of the Dourbie against a very furious squally and warm S.E. wind, under a sky overcast much as one sees in Algeria when a sirocco has been blowing for one or two days. On May 31st the wind, still S.E., was less violent but more steady. At 4 p.m. we reached, in wet fog, the Col de l'Esperou, 4034 ft. on the watershed between the Bay of Biscay and the Mediterranean. The fog got denser and about dusk turned to rain which continued till 4 p.m. next day, a *very* rapid driving rain with small drops; wind still from S.E. and temperature ranging from 47° to 50°. At 7 p.m. it began again more heavily than before, with thunder and lightning, and continued without intermission till 4 p.m. on June 2nd, when it suddenly ceased, turning to thick fog again.

The next morning, passing the Col de Sereyrède at 9 a.m. I was lucky enough to see the rain being measured. The measuring glass was filled seven times and the total was 1·67 in. But this was only since 9 a.m. on June 2nd. To the credit of June 1st there had been 2·83 in., and to May 31st 2·31 in., or 6·81 in. in the 44 hours, of which *about* 2·75 in. may have fallen in the first of the two rains and *about* 4 in. the second.

On June 4th we visited the famous Observatory on the top of Mt. Aigonal, 5140 ft., where they kindly allowed me to copy several interesting figures. The big rain just described had been considerably less at the Observatory, only 4·00 in. against the 6·81 in. at the Col de Sereyrède, which is but  $2\frac{1}{2}$  miles distant.

Looking at the Observatory records for 1911 and 1912 I saw that 1911 had been as remarkable there for summer heat and drought as it was in England, and that 1912 was as pre-eminent for chill and wet.

The rainfall for June, July and August was 8·63 in. in 1911, and 23·27 in. in 1912. In 1912 the absolute maximum in shade was but 72°·7 Fahr., and that occurred on May 13th; but in 1911 June had 74°·1, July 77°·4, and August 81°.

There was a note against the summer of 1912—"The coldest and wettest summer in 40 years"; and against August in particular—"The wettest August since 1900." The rainfall for the whole year was 99·41 in. on 165 days.

H. A. BOYS, F.R.Met.Soc.

*North Cadbury Rectory, August 4th, 1913.*



## PROFESSOR BJERKNES ON DYNAMIC METEOROLOGY AND HYDROGRAPHY.\*

By L. C. W. BONACINA.

It will be remembered that Professor Bjerknæs of Christiania delivered a course of learned lectures on this subject at University College, London, during May, 1910. The substance of them is now embodied in a handsome work, constituting Publication No. 88 of the Carnegie Institution of Washington. It consists of two separate volumes, Parts I. and II., together with a large atlas of charts to illustrate concrete examples of conditions discussed in the text. The work is a fine attempt to construct, upon the basis of the known laws of physics, a comprehensive scheme for the co-ordination of meteorological observations with a view to their ultimate utility in the solution of the great problem of the weather, and as such must take high rank in the philosophy of meteorology. It is hopeless to try to review within the limits of a magazine article the mathematical contents, including the discussion of wave motion, of the various chapters of the two volumes before us, and it must suffice to outline the essential points to be grasped in studying Professor Bjerknæs' method of handling the abstruse problems presented to us in the phenomena of the atmosphere and hydrosphere. Part I., entitled *Statics*, discusses hydrostatic problems of air and ocean, whilst Part II., *Kinematics*, introducing the element of time, leads on to the representation of the actual variable states of atmosphere and hydrosphere. A few words must be said concerning the system of units which Professor Bjerknæs and his collaborators have found it advisable to adopt. Since, for the purposes of dynamic meteorology and hydrography, the centimetre and gramme are too small as units of length and mass respectively, the metre and metric ton are chosen—the latter quantity being the mass of a cubic metre of water at maximum density. The second, though far too small, is, owing to practical difficulties in the way of making a change, retained as the unit of time; and the system thus becomes named the *metre-ton-second* or *m.t.s.* system, from which are derived naturally the units of velocity, acceleration, momentum, force, &c. An important consideration for meteorologists is the unit of pressure in this new system. This is the pressure of the unit force = force giving mass of a ton the acceleration of 1 metre per second ( $M L T^{-2}$ ) exerted over the area of a square metre, and is equal to 10,000 c.g.s. units of pressure or 10,000 dynes per square centimetre. The megadyne per square centimetre is approximately equal to the pressure of the atmosphere, and it has often been proposed to introduce it as a practical unit of pressure, and to designate it by some such name as

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\* We follow Professor Bjerknæs in the use of the Scandinavian form "Hydrography," though we cannot do so without a protest that *Oceanography* should be used to avoid adding a third aspect to the ambiguity which already besets Hydrography as a geographical term.—ED. S.M.M.

a "bar." The m.t.s. unit of pressure will then be the centi-bar, and the c.g.s. the micro-bar.

If we take pure water at maximum density, and neglect its compressibility, we find that 1 bar = pressure of 1 dynamic decametre of water, 1 deci-bar = that of 1 dynamic metre of water, 1 centi-bar = that of 1 dynamic decimetre of water, 1 milli-bar = that of 1 dynamic centimetre of water, and that the c.g.s. unit the micro-bar = pressure of 10 dynamic microns of water. The millibar is the most convenient technical unit for replacing the present universally used millimetre, or inch of mercury, in reading the barometer. The pressure exerted by 1 inch of mercury at 0° C. (on the assumption that its density is 13.59545 and that the value of gravity at the place is 9.80617) is 1.333193 millibars, so that the scale divisions of a barometer which gives direct readings in millibars are .756079 mm. apart, or say .76 mm. Barometric readings in inches, or millimetres, have hitherto served perfectly well because pressure records have been used for *qualitative* purposes only, but they no longer avail when meteorological data are employed *quantitatively*, i.e., to serve for the pre-calculation of ensuing atmospheric changes, in accordance with the avowed aim of the new method. Professor Bjerknes aptly styles the millibar a *rational* unit as contrasted with the inch or millimetre which are both purely arbitrary, and as such would cause endless trouble if used in complicated calculations.

It is necessary now to turn to some general considerations on the object and methods of dynamic meteorology and hydrography. The problem must, of course, be considered from the mathematical point of view, and consequently it becomes necessary to define our independent and dependent variable quantities. The so called independent variables are *co-ordinates*, viz.; latitude, longitude, and height with reference to a certain level like that of the sea surface, and *time*. The dependent variables will be the quantities required for defining the state of the atmosphere and hydrosphere, or formulating the laws of change, and will be designated meteorological or hydrographic *elements*, the distribution in space of any of these elements being called its *field*. At least five fields must enter into the adequate description of atmospheric states, namely, those of pressure, mass, temperature, humidity and motion, of which the first four quantities are *scalars*, and the fifth a *vector*. The five corresponding fields for the hydrosphere are the same except that salinity takes the place of humidity. For the complete representation of atmospheric states we should no doubt have to introduce electric, magnetic, and even other fields, but it is wise at first not to complicate the problem with more fields than are fundamentally necessary. The fields of pressure, temperature, humidity and salinity, are described by the values observed in different points of space; that of mass is described either by the scalar element mass per unit volume (density), or by the scalar element volume of unit mass (specific volume), while the field of motion is described either by the vector element velocity, or

specific momentum. With this definition of the variables the problem of meteorology and hydrography can be concisely stated as the *investigation of the meteorological and hydrographic elements as functions of co-ordinates and time*.

We can now proceed along one of two ways, which lead to essentially different branches of meteorological and hydrographic science. If we give constant values to the co-ordinates, we can examine the effect of letting time vary. This introduces us to the *climatological* method, to be forthwith explained. If, on the other hand, we give constant value to time, we may study the result of allowing the co-ordinates to vary. This is the *dynamic* method, to be herewith explained likewise. The climatological method is already familiar in the system of self-recording instruments which are set up at a number of fixed points in the atmosphere and hydrosphere, and whose records show directly the effect of letting the time vary while the co-ordinates have constant values defining a certain station. When these records are examined great irregular changes appear, but there are also indications of regular variation, and when averages are formed the irregular changes more or less disappear. The regular changes will then, for the most part, present a periodical character corresponding to diurnal and seasonal changes, sunspot periods, and perhaps other unknown cosmic phenomena. In addition slow secular changes may be discovered. The averages of the elements thus formed may be called the *climatological* elements for atmosphere or hydrosphere, and from a comparison of the average elements at different stations climatological maps may be prepared. The irregular phenomena are, as we have just seen, eliminated in the process, but the investigation of their nature or causes leads us to the other method—the dynamic. In this the records obtained from the same set of self-recording elements may be used, but, time given a certain constant value, the values of the meteorological or hydrographic elements at this epoch are read off from all the records, and a continuous synoptical representation of the field of each element drawn.

A new constant value is next given to time, and a synoptical representation of the elements made for the second epoch, and so on. "A series of pictures," to quote the following passage direct from Professor Bjerknes as being of great importance and containing the gist of the whole matter, "being produced, the next step will be to make them the subject of a comparative investigation. This comparative investigation of the successive states must lead to the solution of the ultimate problem of meteorological or hydrographic science, viz., that of discovering the laws according to which an atmospheric or hydrographic state develop out of the preceding one. We shall call this the *dynamic* method; for in virtue of the laws of hydro-dynamics and thermo-dynamics which govern atmospheric or hydrospheric phenomena, preceding states are in relation of causality to subsequent states. Inasmuch as we know the laws of hydro-dynamics and thermo-dynamics, we know the intrinsic laws according

to which the subsequent states develop out of the preceding ones. We are therefore entitled to consider the ultimate problem of meteorological and hydrographic science, that of the precalculation of future states, as one of which we already possess the *implicit* solution, and we have full reason to believe that we shall succeed in making this solution an *explicit* one according as we succeed in finding the methods of making full practical use of the laws of hydrodynamics and thermo-dynamics." In this connection the present writer, whilst making no claim to have done any laborious constructive work like that under discussion, ventures to remark that as far back as May, 1904, and subsequently, he drew emphatic attention in articles published in this Magazine to the causal relationship that must subsist between successive states of weather and which represents the unknown hydro-dynamic laws which govern the subsequent movements of a fluid like the ocean or the atmosphere once set in motion and change by external agencies acting upon it, namely, solar radiation, the rotation of the Earth, and the physical differences of land and water. But if the intervals between the epochs of time in Professor Bjerknes' dynamic method of investigation of atmospheric states were small enough, our knowledge of physics would, according to him, enable us to calculate the development of one atmospheric state out of another—in other words, it would enable us to bridge our ignorance of the manner in which a circulating body like the atmosphere or ocean breaks up into streams and eddies when initially set in motion through inequalities of temperature. Here it is evidently necessary to indicate roughly the preliminary organization of the observations which Bjerknes would establish. In the first place, the dynamic method requires simultaneous, or practically simultaneous, observations, and the next questions are those of the *distribution in space* of each set of simultaneous observations, and the *distribution in time* of the successive epochs of observation. The fundamental laws of hydro-dynamics and thermo-dynamics have the form of partial differential equations which give relations between the *continuous* space-variations and time-variations of the different elements, and hence in practice it is necessary to realize *continuity* in time and space as far as possible. In other words, it is important that the distances in space between the points of observation, and the distances in time between the epochs of observation, be small enough to be used with a certain degree of approximation as line-differentials and time-differentials respectively. With regard to the distribution in space of the points of observation, the condition is fulfilled by the possibility of drawing synoptical maps, giving continuous representation of the fields of the different elements observed. The distances to be allowed in the net of observations will therefore depend upon the space variations of the elements, and so the network must be satisfactory for that element, namely, wind, which has the strongest space variations. For the lowest strata of the atmosphere the network of observations actually



existing in Europe, the United States and India is on the whole fairly satisfactory. In the upper air observations need not be so close as on the ground where the local influences of configuration increase the variation of meteorological elements horizontally; but experience alone can show how close the aerological stations should be.

As regards the distances in time between the epochs of observation, a suitable time-differential must be determined by a comparison of synoptic charts representing the field of the same element at successive epochs, and must be chosen so as to suit the element which has the most rapid time-variation—in this case also the velocity of the wind. The changes which the element has undergone from epoch to epoch will, if small enough, enable approximate values of the time-derivative of the element to be found. From preliminary experience of certain charts (discussed in Chapters XII. and XIII. of Part II.), Professor Bjerknes thinks it reasonable to try time-differentials of three hours for the element of wind (velocity), while differentials of double the length may be used for the other elements.

In regard to hydrography, it need only be said here that although oceanographic observations are not yet organized systematically, the general principles will be the same as those for the meteorological observations. Following an analogy afforded by medical terminology, Professor Bjerknes calls the representation of the fields of the different elements the problem of *diagnosis*, whilst the problem of the precalculation of future states from existing ones, he names the *prognosis*. To quote Professor Bjerknes, his own statement of the latter problem is, "The present state being diagnosed, the final problem is that of the precalculation of future states. The solution of this problem will involve the simultaneous use of all intrinsic relations of hydro-dynamic and thermo-dynamic origin, to be used in connection with the initial conditions, the surface conditions, and data regarding exterior effects of terrestrial or cosmic origin. Evidently the problem is of enormous complexity. But in order to prepare its solution, we shall solve one by one a series of partial problems belonging to it. For every equation introduced we shall examine its prognostic as well as its diagnostic value. In kinematics we shall meet with the first partial problem of prognosis, for the definition of the fundamental kinematic vectors involves the idea of time. When we know the instantaneous velocity of a moving particle, we shall know the place of this particle a differential of time later. The changes of place of the moving particle can therefore be determined in the first approximation by purely kinematic principles. The solution of this problem of kinematic prognosis is the first step in the solution of the general problem."

Concerning the method of research, suffice it to say, in conclusion, that if the refractory problem of meteorology eventually yields to this mode of attack, it is Professor Bjerknes who will surely be recognised as the pioneer in so far as any individual in a co-operative science like meteorology can claim the lion's share of the honours due.

## REVIEWS.

*The Atmosphere*, by A. J. BERRY, M.A., Lecturer in Chemistry at Downing College, Cambridge. University Press, 1913. Size  $6\frac{1}{2} \times 5$ , pp. vi. + 146. Price 1s. net.

METEOROLOGY is expressly excluded from this little volume which deals with air rather than the atmosphere. The author's standpoint is the historical development of the chemistry of air, which extends from the horror of a vacuum to radio-activity and ionisation, furnishing a concise and accurate little handbook. The concluding chapter on the probable composition of the atmosphere in early geological time might, we think, have been excluded, as the speculations dealt with are indeterminate and controversial.

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*Weather Bound*, by RUPERT TUBERVILLE SMITH. Birmingham, Cornish Brothers, Ltd. Size  $10 \times 6\frac{1}{2}$ , pp. iv.+320. Price 15s.

MR. R. T. SMITH shows himself in this book to be an enthusiastic meteorological observer, and the pages bear evidence that the compilation of the work was a labour of love and a source of pleasure to the author. In these respects we think that the book will interest and stimulate others like-minded with Mr. Smith; but we hope that they will not feel themselves compelled to prepare their observations in book form without first consulting some competent meteorological authority, as, in our opinion, a record to be worth the bestowal of such labour in presentment requires to be very long and very homogeneous, as well as very accurate.

The greater part of the volume consists of a twenty-seven years' meteorological diary and discussions, statistical and graphic of the various observations made successively at Round Oak, Rowley Regis, West Bromwich, Handsworth and Tettenhall. The dates of removal from one station to another are occasionally but not always, as far as we can see, recorded in the diary, and the author treats the whole period of twenty-seven years as if it were a homogeneous record. Although he points out that at some of his stations the exposure of the instruments was good, while in one at least it was bad. The data are discussed with reference to sunspot periods and terrestrial magnetism.

The introductory letterpress includes some rather disjointed quotations and opinions on meteorological matters, not always accurate, *e.g.*, the statement on p. 29, "evaporation from a still surface of water is equal to the rainfall," this is certainly not the case in the British Isles. Again, on p. 31, it is inaccurately stated that "the keeping of records of rain-spells has now been discontinued by the rainfall authorities. See *British Rainfall*." The reverse is the case, rain-spells are now more systematically treated than formerly.

## UPPER AIR EXPLORATION IN AUSTRALIA.

SOME interesting details of the upper air investigations which Mr. H. A. Hunt, the Commonwealth Meteorologist, has been pursuing in Victoria, are contained in the Melbourne newspaper, *The Age*, for July 9th last. The primary object of the investigations has been to determine the height of the lower limit of the stratosphere in southern latitudes. During May and June last 13 sounding balloons were liberated in Melbourne, of which 8 were found and returned to the Weather Bureau. It is to be regretted that lack of the necessary equipment, and the difficulty of obtaining supplies of pure hydrogen, have so far confined the experiments to ascents from Melbourne, but it appears probable that before long simultaneous ascents may be made from the Universities in the various States of the Commonwealth.

The first balloon liberated, owing to leakage, did not reach any great altitude, but later ascents were much more successful. No. 5, liberated on May 14th in a south-east wind, reached the stratosphere at a height of six miles, at which altitude the temperature was  $-58^{\circ}$  F., and at seven and a half miles, the greatest height reached, it was  $-50^{\circ}$ . No. 7, which was liberated on May 20th with a south-west wind blowing, was found at Rose River on June 20th, and in spite of the fact that the instrument had been exposed to the weather for a month, the trace was still clearly decipherable. This meteorograph indicated the height of the commencement of the stratosphere as eight and a half miles, at which the temperature was  $-77^{\circ}$ , and at the greatest height reached, nine miles, the temperature was  $-74^{\circ}$ . No. 8, liberated on May 23rd, was found the same day, and showed at the lower limit of the stratosphere, seven miles, a temperature of  $-76^{\circ}$ . This balloon reached a height of nearly eleven miles, where the temperature was  $-71^{\circ}$ . No. 12, liberated on June 10th, and found at Pastoria East, reached the commencement of the stratosphere at a height of eight miles, and the temperature at that point was  $-65^{\circ}$ . The greatest height reached was ten and a half miles, where the temperature was  $-60^{\circ}$ . Six small pilot balloons were also liberated for the purpose of studying the strength and direction of flow of air currents at various altitudes.

Of the four balloons liberated when a south-west wind was blowing, only one was recovered. This is attributable to the fact that the greater part of the north-east of Victoria, in which part the balloons probably fell, is mountainous and heavily timbered. The other two balloons which were not recovered were liberated when the wind was northerly. Two of the balloons were found in tree tops, and attention was doubtless drawn to them by the attached red silk ribbons.

Mr. Hunt and the staff of the Commonwealth Weather Bureau are to be congratulated on the success of these initial experiments in Victoria. When the field of operations is extended so as to embrace the whole of the Australian continent, we may look forward to the acquisition of much valuable data.

## INTERNATIONAL BALLOON ASCENTS.

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

*December 10th, 1910.*

| Starting Point.   | Country.    | A ( $H_c$ )<br>miles. | B ( $T_c$ )<br>° F. | C<br>miles. | D<br>° F. | E<br>miles. | F        |
|-------------------|-------------|-----------------------|---------------------|-------------|-----------|-------------|----------|
| Pyrton Hill.....  | England ..  | 5·8                   | —69                 | 8·1         | —71       | 38          | N.W.     |
| Brussels .....    | Belgium ..  | 7·7                   | —86                 | 9·5         | —75       | 79          | N. by W. |
| Lindenberg .....  | Germany..   | 7·6                   | —78                 | 9·4         | —70       | 9           | E.S.E.   |
| Strassburg .....  | „ ..        | 6·0                   | —69                 | 7·2         | —72       | 40          | N.N.W.   |
| Munich .....      | „ ..        | —                     | —                   | 6·6         | —81       | 11          | N.W.     |
| Vienna .....      | Austria ... | 7·9                   | —86                 | 12·6        | —76       | 11          | S. by E. |
| Pavlovsk .....    | Russia .... | 6·6                   | —90                 | 8·6         | —79       | 45          | N.E.     |
| Nishni Olchedaëff | „ ....      | 6·6                   | —56                 | 9·7         | —69       | 39          | S.S.E.   |

A low pressure area lay over the Channel and moved across the Bay of Biscay the next day. An extensive anticyclone lay over Russia.

The low temperature of  $-90^\circ$  over St. Petersburg is remarkable, as the high latitude and comparatively low value of  $H_c$  are both usually associated with a higher temperature.

*January 5th, 1911.*

| Starting Point    | Country.    | A ( $H_c$ )<br>miles. | B ( $T_c$ )<br>° F. | C<br>miles. | D<br>° F. | E<br>miles. | F          |
|-------------------|-------------|-----------------------|---------------------|-------------|-----------|-------------|------------|
| Manchester.....   | England ..  | 6·5                   | —67                 | 10·5        | —62       | 80          | S.         |
| Pyrton Hall ....  | „ ..        | 5·2                   | —58                 | 6·6         | —62       | 28          | S.S.W.     |
| Brussels .....    | Belgium ..  | 5·9                   | —69                 | 10·7        | —57       | 64          | S.W.       |
| Hamburg .....     | Germany..   | 5·4                   | —59                 | 9·2         | —61       | 39          | W. by S.   |
| Lindenberg.....   | „ ..        | 6·1                   | —61                 | 9·6         | —59       | 33          | N.W. by W. |
| Paris .....       | France ...  | 5·5                   | —70                 | 6·4         | —62       | 31          | S.S.W.     |
| Strassburg .....  | Germany..   | 5·6                   | —71                 | 6·1         | —65       | 27          | S.W. by W. |
| Munich .....      | „ ..        | 5·6                   | —77                 | 6·0         | —70       | 14          | N.W.       |
| Vienna .....      | Austria.... | 6·2                   | —67                 | 8·6         | —62       | 44          | N. by W.   |
| Pavlovsk .....    | Russia .... | 6·3                   | —77                 | 8·3         | —73       | 40          | N.W. by N. |
| Nishni Olchedaëff | „ ..        | 6·6                   | —74                 | 7·4         | —66       | 46          | N.E.       |

A Height in miles of commencement of isothermal column.

B Temperature,  $F^\circ$ , at bottom of column.

C Greatest height of reliable record in miles.

D Temperature,  $F^\circ$ , at greatest height.

E Distance in miles of point where balloon fell.

F Bearing of falling point from starting point.

On January 4th a low pressure area lay over the west of the Mediterranean and remained stationary for some days. There was a very deep depression over Iceland and a very high pressure over Russia.

## RAINFALL TABLE FOR AUGUST, 1913.

| 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. | 1913.<br>in. |
| Camden Square.....                   | London.....          | 51 32      | 0 8                  | 111                            | 2'39                           | 1'43         |
| Tenterden.....                       | Kent.....            | 51 4       | *0 41                | 190                            | 2'42                           | 1'46         |
| Arundel (Patching).....              | Sussex.....          | 50 51      | 0 27                 | 130                            | 2'52                           | 3'83         |
| Fawley (Cadland).....                | Hampshire.....       | 50 50      | 1 22                 | 52                             | 2'85                           | ...          |
| Oxford (Magdalen College).....       | Oxfordshire.....     | 51 45      | 1 15                 | 186                            | 2'44                           | '76          |
| Wellingborough (Croyland Abbey)..... | Northampton.....     | 52 18      | 0 41                 | 174                            | 2'38                           | 1'71         |
| Shoeburyness.....                    | Essex.....           | 51 31      | *0 48                | 13                             | 1'74                           | '35          |
| Bury St. Edmunds (Westley).....      | Suffolk.....         | 52 15      | *0 40                | 226                            | 2'52                           | 1'72         |
| Geldeston [Beccles].....             | Northfolk.....       | 52 27      | *1 31                | 38                             | 2'22                           | ...          |
| Polapit Tamar [Launceston].....      | Devon.....           | 50 40      | 4 22                 | 315                            | 3'17                           | 1'06         |
| Rousdon [Lyme Regis].....            | „.....               | 50 41      | 3 0                  | 516                            | 2'84                           | 1'30         |
| Stroud (Upfield).....                | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 2'90                           | 1'29         |
| Church Stretton (Wolstaston).....    | Shropshire.....      | 52 35      | 2 48                 | 800                            | 3'43                           | 1'32         |
| Coventry (Kingswood).....            | Warwickshire.....    | 52 24      | 1 30                 | 340                            | 2'81                           | '49          |
| Boston.....                          | Lincolnshire.....    | 52 58      | 0 1                  | 11                             | 2'39                           | '90          |
| Worksop (Hodsock Priory).....        | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 2'55                           | 1'43         |
| Macclesfield.....                    | Cheshire.....        | 53 15      | 2 7                  | 501                            | 3'76                           | 2'22         |
| Southport (Hesketh Park).....        | Lancashire.....      | 53 38      | 2 59                 | 38                             | 3'73                           | 1'49         |
| Arncliffe Vicarage.....              | Yorkshire, W.R.....  | 54 8       | 2 6                  | 732                            | 5'62                           | 2'06         |
| Wetherby (Rihston Hall).....         | „.....               | 53 59      | 1 24                 | 130                            | 2'78                           | 1'10         |
| Hull (Pearson Park).....             | „ E.R.....           | 53 45      | 0 20                 | 6                              | 3'05                           | '72          |
| Newcastle (Town Moor).....           | Northumberland.....  | 54 59      | 1 38                 | 201                            | 3'20                           | 1'13         |
| Borrowdale (Seathwaite).....         | Cumberland.....      | 54 30      | 3 10                 | 423                            | 11'47                          | 7'19         |
| Cardiff (Ely).....                   | Glamorgan.....       | 51 29      | 3 13                 | 53                             | 4'54                           | 1'63         |
| Haverfordwest.....                   | Pembroke.....        | 51 48      | 4 58                 | 90                             | 4'21                           | 1'84         |
| Aberystwyth (Gogerddan).....         | Cardigan.....        | 52 26      | 4 1                  | 83                             | 4'88                           | 3'16         |
| Llandudno.....                       | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 3'16                           | 2'26         |
| Cargen [Dumtries].....               | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 4'23                           | 1'65         |
| Marchmont House.....                 | Berwick.....         | 55 44      | 2 24                 | 498                            | 3'54                           | 1'56         |
| Girvan (Pinmore).....                | Ayr.....             | 55 10      | 4 49                 | 207                            | 4'54                           | 1'92         |
| Glasgow (Queen's Park).....          | Renfrew.....         | 55 53      | 4 18                 | 144                            | 3'62                           | 1'19         |
| Inveraray (Newtown).....             | Argyll.....          | 56 14      | 5 4                  | 17                             | 6'02                           | 3'35         |
| Mull (Quinish).....                  | „.....               | 56 34      | 6 13                 | 35                             | 5'00                           | 2'11         |
| Dundee (Eastern Necropolis).....     | Forfar.....          | 56 28      | 2 57                 | 199                            | 3'34                           | 1'37         |
| Braemar.....                         | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | 3'63                           | 1'02         |
| Aberdeen (Cranford).....             | „.....               | 57 8       | 2 7                  | 120                            | 3'07                           | 1'38         |
| Cawdor.....                          | Nairn.....           | 57 31      | 3 57                 | 250                            | 3'05                           | '75          |
| Fort Augustus (S. Benedict's).....   | E. Inverness.....    | 57 9       | 4 41                 | 68                             | 3'52                           | 1'21         |
| Loch Torridon (Bendamph).....        | W. Ross.....         | 57 32      | 5 32                 | 20                             | 6'61                           | 2'60         |
| Dunrobin Castle.....                 | Sutherland.....      | 57 59      | 3 56                 | 14                             | 2'71                           | 1'19         |
| Wick.....                            | Caithness.....       | 58 26      | 3 6                  | 77                             | 2'73                           | 1'27         |
| Killarney (District Asylum).....     | Kerry.....           | 52 4       | 9 31                 | 178                            | 4'57                           | 1'78         |
| Waterford (Brook Lodge).....         | Waterford.....       | 52 15      | 7 7                  | 104                            | 3'73                           | 2'24         |
| Nenagh (Castle Lough).....           | Tipperary.....       | 52 54      | 8 24                 | 120                            | 4'04                           | 1'62         |
| Ennistymon House.....                | Clare.....           | 52 57      | 9 18                 | 37                             | 5'01                           | 2'60         |
| Gorey (Courtown House).....          | Wexford.....         | 52 40      | 6 13                 | 80                             | 3'31                           | '97          |
| Abbey Leix (Blandsfort).....         | Queen's County.....  | 52 56      | 7 17                 | 532                            | 3'94                           | 1'00         |
| Dublin (Fitz William Square).....    | Dublin.....          | 53 21      | 6 14                 | 54                             | 3'08                           | '94          |
| Mullingar (Belvedere).....           | Westmeath.....       | 53 29      | 7 22                 | 367                            | 4'00                           | 1'36         |
| Crossmolina (Enniscoe).....          | Mayo.....            | 54 4       | 9 16                 | 74                             | 4'68                           | 1'43         |
| Cong (The Glebe).....                | „.....               | 53 33      | 9 16                 | 112                            | 4'70                           | '92          |
| Collooney (Markree Obsy.).....       | Sligo.....           | 54 11      | 8 27                 | 127                            | 4'30                           | 1'58         |
| Seaforde.....                        | Down.....            | 54 19      | 5 50                 | 180                            | 3'64                           | '99          |
| Bushmills (Dundarave).....           | Antrim.....          | 55 12      | 6 30                 | 162                            | 4'06                           | 2'57         |
| Omagh (Edenfel).....                 | Tyrone.....          | 54 36      | 7 18                 | 280                            | 4'22                           | 1'21         |

RAINFALL TABLE FOR AUGUST, 1913—*continued.*

| RAINFALL OF MONTH ( <i>con.</i> ) |          |                   |             |  | 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. in.  | 1913. in. | Diff. from Aver. in. | % of Av. |                        |                 |
|                                   |          | in. Date.         |             |  |                       |           |                      |          | in.                    |                 |
| — .96                             | 60       | .53 31            | 11          |  | 15.92                 | 14.41     | —1.51                | 91       | 25.11                  | Camden Square   |
| — .96                             | 60       | .55 30            | 11          |  | 16.07                 | 15.52     | — .55                | 97       | 27.64                  | Tenterden       |
| +1.31                             | 152      | 2.32 31           | 11          |  | 17.44                 | 23.62     | +6.18                | 135      | 30.48                  | Patching        |
| ...                               | ...      | ...               | ...         |  | 18.58                 | ...       | ...                  | ...      | 31.87                  | Cadland         |
| —1.68                             | 31       | .22 24            | 8           |  | 15.47                 | 12.95     | —2.52                | 84       | 24.58                  | Oxford          |
| — .67                             | 72       | 1.11 29           | 10          |  | 16.06                 | 14.62     | —1.44                | 91       | 25.17                  | Croyland Abbey  |
| —1.39                             | 20       | .12 30            | 8           |  | 11.47                 | 10.86     | — .61                | 95       | 19.28                  | Shoeburyness    |
| — .80                             | 68       | .76 31            | 8           |  | 15.96                 | 13.95     | —2.01                | 87       | 25.40                  | Westley         |
| ...                               | ...      | ...               | ...         |  | 14.20                 | ...       | ...                  | ...      | 23.73                  | Geldeston       |
| —2.11                             | 33       | .37 31            | 12          |  | 21.79                 | 25.52     | +3.73                | 117      | 38.27                  | Polapit Tamar   |
| —1.54                             | 46       | .64 31            | 9           |  | 19.85                 | 19.03     | — .82                | 96       | 33.54                  | Rousdon         |
| —1.61                             | 44       | .33 26            | 14          |  | 18.73                 | 19.14     | + .41                | 102      | 29.81                  | Stroud          |
| —2.11                             | 38       | .57 22            | 9           |  | 20.31                 | 23.64     | +3.33                | 116      | 32.41                  | Wolstaston      |
| —2.32                             | 17       | .10 29            | 9           |  | 18.16                 | 17.36     | — .80                | 96       | 28.98                  | Coventry        |
| —1.49                             | 38       | .42 31            | 12          |  | 14.60                 | 12.47     | —2.13                | 85       | 23.35                  | Boston          |
| —1.12                             | 56       | .80 22            | 8           |  | 15.70                 | 13.55     | —2.15                | 86       | 24.46                  | Hodsock Priory  |
| —1.54                             | 59       | 1.23 22           | 12          |  | 21.93                 | 22.37     | + .44                | 102      | 34.73                  | Macclesfield    |
| —2.24                             | 40       | .84 22            | 9           |  | 19.61                 | 18.59     | —1.02                | 95       | 32.70                  | Southport       |
| —3.56                             | 37       | .76 21            | 8           |  | 37.59                 | 39.17     | +1.58                | 104      | 61.49                  | Arneliffe       |
| —1.68                             | 40       | .25 23            | 10          |  | 16.97                 | 14.31     | —2.66                | 84       | 26.87                  | Ribston Hall    |
| —2.33                             | 24       | .53 22            | 6           |  | 16.52                 | 12.84     | —3.68                | 78       | 26.42                  | Hull            |
| —2.07                             | 35       | .49 29            | 12          |  | 17.65                 | 16.08     | —1.57                | 91       | 27.94                  | Newcastle       |
| —4.28                             | 63       | 4.32 21           | 12          |  | 76.76                 | 84.49     | +7.73                | 110      | 129.48                 | Seathwaite      |
| —2.91                             | 36       | .34 30            | 15          |  | 25.02                 | 28.07     | +3.05                | 112      | 42.28                  | Cardiff         |
| —2.37                             | 44       | .68 22            | 9           |  | 27.05                 | 30.48     | +3.43                | 113      | 46.81                  | Haverfordwest   |
| —1.72                             | 65       | 1.76 22           | 12          |  | 27.03                 | 37.16     | +10.13               | 137      | 45.46                  | Gogerddan       |
| — .90                             | 72       | .71 22            | 8           |  | 18.05                 | 20.02     | +1.97                | 111      | 30.36                  | Llandudno       |
| —2.58                             | 39       | .98 21            | 10          |  | 26.49                 | 31.32     | +4.83                | 118      | 43.47                  | Cargen          |
| —1.98                             | 44       | .61 29            | 14          |  | 21.22                 | 17.76     | —3.46                | 84       | 33.76                  | Marchmont       |
| —2.62                             | 42       | .55 22            | 12          |  | 29.37                 | 27.12     | —2.25                | 92       | 49.77                  | Girvan          |
| —2.43                             | 33       | .35 21            | 9           |  | 22.04                 | 22.59     | + .55                | 102      | 35.97                  | Glasgow         |
| —2.67                             | 56       | 1.55 21           | 12          |  | 40.06                 | 42.63     | +2.57                | 106      | 68.67                  | Inveraray       |
| —2.89                             | 42       | .69 21            | 13          |  | 32.67                 | 32.15     | — .52                | 98       | 56.57                  | Qninish         |
| —1.97                             | 41       | .44 30            | 10          |  | 18.20                 | 16.42     | —1.78                | 90       | 28.64                  | Dundee          |
| —2.61                             | 28       | .28 24            | 11          |  | 21.43                 | 21.95     | + .52                | 102      | 34.93                  | Braemar         |
| —1.69                             | 45       | .37 30            | 14          |  | 20.09                 | 17.77     | —2.32                | 88       | 32.73                  | Aberdeen        |
| —2.30                             | 25       | .39 24            | 4           |  | 18.70                 | 13.10     | —5.60                | 70       | 29.33                  | Cawdor          |
| —2.31                             | 34       | .61 21            | 9           |  | 26.72                 | 27.08     | + .36                | 101      | 44.53                  | Fort Augustus   |
| —4.01                             | 39       | .77 21            | 12          |  | 49.51                 | 48.43     | —1.08                | 98       | 83.93                  | Bendarnagh      |
| —1.52                             | 44       | .24 25            | 11          |  | 19.90                 | 14.13     | —5.77                | 71       | 31.90                  | Dunrobin Castle |
| —1.46                             | 47       | .21 23            | 17          |  | 18.11                 | 13.03     | —5.08                | 72       | 29.88                  | Wick            |
| —2.79                             | 39       | .43 30            | 11          |  | 32.97                 | 34.84     | +1.87                | 106      | 54.81                  | Killarney       |
| —1.49                             | 60       | 1.30 16           | 9           |  | 24.26                 | 26.52     | +2.26                | 109      | 39.57                  | Waterford       |
| —2.42                             | 40       | .35 21            | 12          |  | 24.57                 | 27.53     | +2.96                | 112      | 39.43                  | Castle Lough    |
| —2.41                             | 52       | .82 10            | 10          |  | 28.25                 | 30.10     | +1.85                | 107      | 46.52                  | Ennistymon      |
| —2.34                             | 29       | .40 22            | 11          |  | 21.63                 | 20.94     | — .69                | 97       | 34.99                  | Courtown Ho.    |
| —2.94                             | 25       | .21 10            | 11          |  | 22.77                 | 25.78     | +3.01                | 113      | 35.92                  | Abbey Leix      |
| —2.14                             | 31       | .30 9             | 10          |  | 17.83                 | 16.67     | —1.16                | 93       | 27.68                  | Dublin          |
| —2.64                             | 34       | .35 20            | 12          |  | 23.17                 | 25.28     | +2.11                | 109      | 36.15                  | Mullingar       |
| —3.25                             | 31       | .33 20            | 13          |  | 31.32                 | 36.00     | +4.68                | 115      | 52.87                  | Enniscoe        |
| —3.78                             | 20       | .25 10            | 10          |  | 29.83                 | 32.87     | +3.04                | 110      | 48.90                  | Cong            |
| —2.72                             | 37       | .31 20            | 12          |  | 26.49                 | 29.10     | +2.61                | 110      | 42.71                  | Markree         |
| —2.65                             | 27       | .30 21            | 10          |  | 24.38                 | 22.75     | —1.63                | 93       | 38.91                  | Seaforde        |
| —1.49                             | 63       | .91 23            | 10          |  | 22.83                 | 19.18     | —3.65                | 84       | 37.56                  | Dundarave       |
| —3.01                             | 29       | .27 21            | 10          |  | 24.66                 | 25.92     | +1.26                | 105      | 39.38                  | Omagh           |

## SUPPLEMENTARY RAINFALL, AUGUST, 1913.

| Div.  | STATION.                      | Rain<br>inches | Div.   | STATION.                      | Rain<br>inches. |
|-------|-------------------------------|----------------|--------|-------------------------------|-----------------|
| II.   | Warlingham, Redvers Road .    | 1·96           | XI.    | Lligwy .....                  | 1·18            |
| „     | Ramsgate .....                | ·92            | „      | Douglas .....                 | ·78             |
| „     | Hailsham .....                | 2·15           | XII.   | Stoneykirk, Ardwell House...  | 1·59            |
| „     | Totland Bay, Aston House...   | 1·74           | „      | Dalry, The Old Garroch.....   | 2·20            |
| „     | Stockbridge, Ashley.....      | 1·04           | „      | Beattock, Kinnelhead .....    | 1·87            |
| „     | Grayshott .....               | 1·35           | „      | Langholm, Drove Road .....    | 2·56            |
| „     | Caversham, Rectory Road ...   | 1·05           | XIII.  | Meggat Water, Cramilt Lodge   | 1·67            |
| III.  | Harrow Weald, Hill House...   | ·98            | „      | North Berwick Reservoir.....  | 1·41            |
| „     | Pitsford, Sedgbrook.....      | ·39            | „      | Edinburgh, Royal Observaty.   | 1·44            |
| „     | Woburn, Milton Bryant.....    | ·86            | XIV.   | Maybole, Knockdon Farm ...    | 1·32            |
| „     | Chatteris, The Priory.....    | 1·98           | XV.    | Ballachulish House .....      | 2·37            |
| IV.   | Colchester, Hill Ho., Lexden  | ·52            | „      | Campbeltown, Witchburn ..     | 1·55            |
| „     | Newport, Belmont House .....  | ·77            | „      | Holy Loch, Ardnadam .....     | 2·65            |
| „     | Ipswich, Rookwood, Copdock    | ·77            | „      | Islay, Eallabus .....         | 2·21            |
| „     | Blakeney .....                | 1·49           | „      | Tiree, Cornaigmore .....      | 1·96            |
| „     | Swaffham .....                | ·81            | XVI.   | Dollar Academy .....          | 1·22            |
| V.    | Bishops Cannings .....        | 2·60           | „      | Balquhiddy, Stronvar.....     | 1·48            |
| „     | Winterbourne Steepleton.....  | ...            | „      | Glenlyon, Meggernie Castle..  | 1·32            |
| „     | Ashburton, Druid House.....   | 1·62           | „      | Blair Atholl .....            | 1·01            |
| „     | Cullompton .....              | 1·95           | „      | Coupar Angus .....            | 1·26            |
| „     | Lynmouth, Rock House .....    | 1·27           | „      | Montrose, Sunnyside Asylum.   | 1·40            |
| „     | Okehampton, Oaklands.....     | 1·41           | XVII.  | Alford, Lynturk Manse .....   | 1·22            |
| „     | Hartland Abbey.....           | 1·05           | „      | Fyvie Castle .....            | 2·37            |
| „     | Probus, Lamellyn.....         | 1·12           | „      | Keith Station .....           | 1·38            |
| „     | North Cadbury Rectory.....    | 1·66           | XVIII. | Alvey Manse.....              | 1·39            |
| VI.   | Clifton, Pembroke Road.....   | 1·61           | „      | Loch Quoich, Loan .....       | 5·70            |
| „     | Ross, The Graig .....         | 1·05           | „      | Drumnadrochit .....           | ·99             |
| „     | Shifnal, Hatton Grange.....   | 1·98           | „      | Skye, Dunvegan .....          | 3·51            |
| „     | Droitwich .....               | 1·36           | „      | N. Uist, Lochmaddy .....      | ...             |
| „     | Blockley, Upton Wold.....     | 1·06           | „      | Glencarron Lodge .....        | 3·29            |
| VII.  | Market Overton.....           | 1·45           | XIX.   | Invershin .....               | 1·35            |
| „     | Market Rasen .....            | 1·29           | „      | Melvich .....                 | ·99             |
| „     | Bawtry, Hesley Hall .....     | 1·16           | „      | Loch Stack, Ardchullin .....  | 1·78            |
| „     | Derby, Midland Railway.....   | 2·15           | XX.    | Skibbereen Rectory .....      | 1·11            |
| „     | Buxton .....                  | 2·01           | „      | Dunmanway, The Rectory ..     | 1·37            |
| VIII. | Nantwich, Dorfold Hall .....  | 1·77           | „      | Glanmire, Lota Lodge, No. 1   | 2·48            |
| „     | Chatburn, Middlewood .....    | 2·03           | „      | Mitchelstown Castle .....     | 1·86            |
| „     | Cartmel, Flookburgh .....     | 2·06           | „      | Darrynane Abbey .....         | 1·51            |
| IX.   | Langsett Moor, Up. Midhope    | 1·41           | „      | Clonmel, Bruce Villa .....    | ·90             |
| „     | Scarborough, Scalby .....     | 1·08           | „      | Newmarket-on-Fergus.Fenloe    | 1·86            |
| „     | Ingleby Greenhow .....        | ...            | XXI.   | Laragh, Glendalough .....     | 1·61            |
| „     | Mickleton .....               | 1·10           | „      | Ballycumber, Moorock Lodge    | 1·04            |
| X.    | Bellingham, High Green Manor  | 2·06           | „      | Balbriggan, Ardgillan .....   | ·41             |
| „     | Ilderton, Lilburn Cottage ... | 1·97           | XXII.  | Woodlawn .....                | 1·77            |
| „     | Keswick, The Bank .....       | 2·16           | „      | Westport, St. Helens ...      | 1·48            |
| XI.   | Llanfrechfa Grange .....      | 1·74           | „      | Dugort, Slievemore Hotel ...  | 2·25            |
| „     | Treherbert, Tyn-y-waun .....  | 3·77           | „      | Mohill Rectory .....          | 1·18            |
| „     | Carmarthen, The Friary .....  | 1·46           | XXIII. | Enniskillen, Portora .....    | ...             |
| „     | Castle Malgwyn [Llechryd]...  | 1·55           | „      | Dartrey [Cootehill] .....     | 1·27            |
| „     | Crickhowell, Tal-y-maes.....  | 3·50           | „      | Warrenpoint, Manor House ..   | ·76             |
| „     | New Radnor, Ednol .....       | 1·81           | „      | Banbridge, Milltown .....     | ·81             |
| „     | Birmingham WW., Tyrmynydd     | 2·21           | „      | Belfast, Cave Hill Road ..... | 1·15            |
| „     | Lake Vyrnwy .....             | ...            | „      | Glenarm Castle.....           | 1·64            |
| „     | Llangyhanfal, Plâs Draw.....  | 2·57           | „      | Londonderry, Creggan Res..    | 2·08            |
| „     | Dolgelly, Bryntririon.....    | 3·64           | „      | Dunfanaghy, Horn Head ...     | 1·75            |
| „     | Bettws-y-Coed, Tyn-y-bryn...  | 1·67           | „      | Killybegs .....               | 2·85            |

## METEOROLOGICAL NOTES ON AUGUST, 1913.

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.—A changeable month, but for the most part fine and sunny. Almost half the rain for the month fell on the last two days. Mean temp.  $61^{\circ}\cdot8$  or  $0^{\circ}\cdot5$  below the average. Duration of sunshine  $140\cdot4^*$  hours, and of R  $22\cdot4$  hours. Evaporation  $2\cdot11$  in. Shade max.  $82^{\circ}\cdot6$  on 28th; min.  $45^{\circ}\cdot2$  on 25th. F 0, f 0.

TENTERDEN.—A dull month with 11 days with temp. above  $70^{\circ}$ . Very dry until the last two days. Shade max.  $83^{\circ}\cdot0$  on 28th; min.  $43^{\circ}\cdot0$  on 9th. F 0, f 0.

TOTLAND BAY.—Duration of sunshine  $179\cdot9^*$  hours, or  $21\cdot3$  hours below the average. Absolute drought from July 20th to August 8th. Shade max.  $72^{\circ}\cdot8$  on 26th; min.  $45^{\circ}\cdot9$  on 6th. F 0, f 0.

MILTON BRYANT.—A hot and dry month. Shade max.  $74^{\circ}\cdot0$  on 27th; min.  $47^{\circ}\cdot0$  on 29th.

IPSWICH, COPDOCK.—A very dry and cool month as a whole; last ten days warmer. Northerly winds predominated and many low minima were noted. Mean temp.  $59^{\circ}\cdot1$ . Duration of sunshine  $159\cdot4$  hours. Shade max.  $80^{\circ}\cdot8$  on 30th; min.  $39^{\circ}\cdot3$  on 7th, the coldest night ever recorded here in August, the grass min. fell to  $29^{\circ}\cdot0$ . F 0, f 1.

POLAPIT, TAMAR.—The driest August since 1870. Very hot until towards the end of the month. Shade max.  $77^{\circ}\cdot9$  on 3rd; min.  $36^{\circ}\cdot5$  on 7th. F 0, f 0.

ROSS.—A dry month. Shade max.  $82^{\circ}\cdot0$  on 23rd; min.  $42^{\circ}\cdot6$  on 6th. F 0, f 0.

HODSOCK PRIORY.—A dull month, very dry for the first three weeks, but with few hot days. Shade max.  $83^{\circ}\cdot7$  on 3rd; min.  $36^{\circ}\cdot9$  on 5th. F 0, f 1.

SOUTHPORT.—Remarkably calm month. Much damage from frost on 19th on the adjacent moss lands. Duration of sunshine  $197\cdot0^*$  hours, or  $13\cdot0$  hours above the average. Duration of R  $37\cdot9$  hours. Evaporation  $2\cdot55$  in. Mean temp.  $58^{\circ}\cdot9$ , or  $0^{\circ}\cdot2$  below the average. Shade max.  $75^{\circ}\cdot0$  on 29th; min.  $41^{\circ}\cdot0$  on 19th. F 0, f 2.

HULL.—Trees and vegetation suffering much from the long drought which continued to 22nd. TSS 24th and 29th. Duration of sunshine  $119\cdot4$  hours. Shade max.  $79^{\circ}\cdot0$  on 3rd and 30th; min.  $43^{\circ}\cdot0$  5th. F 0, f 0.

CARMARTHEN.—A fine, bright and warm month. Water supplies running low. Wheat and oats well harvested, but barley backward.

LLANDUDNO.—Shade max.  $71^{\circ}\cdot0$  on 29th; min.  $46^{\circ}\cdot0$  on 20th.

EDINBURGH.—Shade max.  $76^{\circ}\cdot1$  on 16th; min.  $45^{\circ}\cdot9$  on 11th. F 0, f 1.

ARDNADAM.—First 20 days very dry. Notices of scarcity of water sent out on 1st. Shade max.  $71^{\circ}\cdot4$  on 20th; min.  $41^{\circ}\cdot0$  on 20th. F 0, f 1.

COUPAR ANGUS.—An abundance of sun without any spell of excessive heat, 10 days with temp. above  $70^{\circ}\cdot0$ . Mean temp.  $56^{\circ}\cdot5$ . Shade max.  $81^{\circ}\cdot0$  on 2nd; min.  $35^{\circ}\cdot0$  on 19th.

LOCH STACK.—Duration of sunshine  $85\cdot8$  hours.

DARRYNANE ABBEY.—A very fine and hot month.

WATERFORD.—Shade max.  $81^{\circ}\cdot0$  on 14th; min.  $44^{\circ}\cdot0$  on 25th.

ARDGILLAN.—The driest August recorded here. R  $3\cdot24$  in. below the average. Pastures much burnt up and springs failing. Shade max.  $75^{\circ}\cdot8$  on 14th; min.  $44^{\circ}\cdot0$  on 12th. F 0, f 0.

MARKREE.—A fine, warm, and generally dry month. Shade max.  $73^{\circ}\cdot0$  on 4th; min.  $38^{\circ}\cdot0$  on 5th. F 0, f 4.

\* Campbell-Stokes.

† Jordan.



## Climatological Table for the British Empire, March, 1913.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |        |          |        | Average. |      |               |           | Absolute.       |                   | Total Rain     |       | Aver.<br>Cloud. |
|------------------------------------------------------------------|-----------|--------|----------|--------|----------|------|---------------|-----------|-----------------|-------------------|----------------|-------|-----------------|
|                                                                  | 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                                            | 59°3      | 6      | 26°0     | 18     | 52°0     | 38°1 | 39°6          | 81        | 95·7            | 20·8              | inches<br>2·29 | 21    | 7·2             |
| Malta ... ..                                                     | 69·3      | 23     | 45·8     | 4      | 61·8     | 53·3 | ...           | 82        | 133·4           | ..                | 1·38           | 3     | 5·9             |
| Lagos ... ..                                                     | 97·5      | 16     | 71·3     | 25     | 89·3     | 77·3 | 74·2          | 71        | 150·5           | 69·0              | 1·05           | 2     | 5·4             |
| Cape Town ... ..                                                 | 95·7      | 3      | 54·0     | 22     | 80·9     | 60·5 | 57·4          | 67        | ...             | ...               | ·11            | 3     | 2·7             |
| Natal, Durban ... ..                                             | 79·0      | 22     | 63·0     | 4      | 74·2     | 67·0 | 67·3          | 83        | ...             | ...               | 21·09          | 16    | 5·5             |
| Johannesburg ... ..                                              | 80·5      | 6      | 42·8     | 2      | 71·7     | 52·6 | 52·0          | 79        | 150·5           | 41·3              | 4·47           | 15    | 5·6             |
| Mauritius ... ..                                                 | 87·2      | 10     | 63·8     | 16     | 84·0     | 71·1 | 70·5          | 80        | 156·0           | 56·1              | 2·89           | 12    | 5·8             |
| Bloemfontein ... ..                                              | ...       | ...    | ...      | ...    | ...      | ...  | ...           | ...       | ...             | ...               | ...            | ...   | ...             |
| Calcutta... ..                                                   | 98·7      | 28     | 57·3     | 1, 2   | 89·2     | 68·3 | 64·3          | 64        | ...             | 50·6              | ·87            | 2     | 1·6             |
| Bombay... ..                                                     | 89·1      | 23     | 67·3     | 2      | 85·1     | 71·3 | 67·1          | 71        | 125·4           | 59·3              | ...            | ..    | 0·6             |
| Madras ... ..                                                    | 97·2      | 30     | 69·2     | 26     | 92·0     | 73·1 | 70·5          | 72        | 141·5           | 65·3              | ·00            | 0     | 1·0             |
| Colombo, Ceylon ... ..                                           | 91·9      | 1      | 68·4     | 15     | 89·0     | 73·0 | 73·8          | 81        | 161·4           | 60·9              | 8·07           | 8     | 4·9             |
| Hongkong ... ..                                                  | 77·7      | 20     | 49·6     | 24     | 65·8     | 58·5 | 55·8          | 79        | ...             | ...               | 6·95           | 16    | 8·4             |
| Sydney ... ..                                                    | 94·0      | 6      | 49·0     | 28     | 77·5     | 62·0 | 55·8          | 63        | 151·2           | 39·9              | 8·88           | 12    | 3·4             |
| Melbourne ... ..                                                 | 95·6      | 3      | 44·5     | 17     | 70·0     | 54·3 | 50·1          | 64        | 147·1           | 40·0              | 5·14           | 23    | 7·2             |
| Adelaide ... ..                                                  | 100·1     | 2      | 48·7     | 30     | 78·1     | 58·8 | 53·1          | 57        | 156·7           | 40·8              | 1·20           | 7     | 4·5             |
| Perth ... ..                                                     | 98·0      | 7      | 50·3     | 12     | 81·4     | 61·3 | 58·9          | 62        | 159·4           | 41·5              | ·52            | 5     | 3·1             |
| Coolgardie ... ..                                                | 101·6     | 21     | 47·2     | 12     | 84·1     | 58·8 | 49·2          | 44        | 164·0           | 42·0              | ·06            | 4     | 4·2             |
| Hobart, Tasmania .. ..                                           | 86·0      | 3      | 40·0     | 16     | 64·4     | 49·2 | 45·3          | 66        | 135·8           | 32·1              | 1·91           | 15    | 7·1             |
| Wellington ... ..                                                | 72·4      | 22     | 43·0     | 25     | 66·8     | 55·7 | 53·5          | 76        | 136·4           | 33·0              | 2·83           | 16    | 6·8             |
| Auckland ... ..                                                  | 78·0      | 14, 17 | 49·5     | 24, 30 | 72·1     | 58·1 | 58·3          | 80        | 147·0           | 46·0              | 2·34           | 9     | 5·0             |
| Jamaica, Kingston .. ..                                          | 90·2      | 2      | 66·1     | 3      | 86·5     | 69·3 | 66·3          | 72        | ...             | ...               | ·47            | 3     | 3·8             |
| Grenada ... ..                                                   | 83·0      | sev.   | 68·0     | 17     | 81·4     | 70·9 | ...           | 72        | 137·0           | ...               | 3·42           | 21    | 3·0             |
| Toronto ... ..                                                   | 64·2      | 24     | —2·7     | 7      | 41·9     | 24·7 | 25·5          | 78        | ...             | —3·3              | 4·08           | 18    | 6·0             |
| Fredericton ... ..                                               | 60·0      | 21     | —9·0     | 8      | 39·3     | 21·3 | ...           | 84        | ...             | ...               | 6·00           | 18    | 6·1             |
| St. John, N.B. ... ..                                            | 52·3      | 31     | —4·8     | 8      | 39·5     | 26·6 | 29·0          | 81        | ...             | ...               | 7·60           | 19    | 6·4             |
| Edmonton, Alberta ... ..                                         | 51·5      | 7      | —15·0    | 19     | 30·3     | 9·1  | ...           | 65        | 109·5           | —20·0             | ·48            | 11    | 5·9             |
| Victoria, B.C. ... ..                                            | 56·6      | 7      | 22·7     | 20     | 47·6     | 35·1 | 36·0          | 82        | ...             | ...               | 2·00           | 16    | 5·9             |

MALTA.—Mean temp. of air 56°·8. Average daily sunshine 7·5 hours.

LAGOS.—Intensely hot throughout the month.

Natal, Durban.—Rainfall caused floods and damage.

Johannesburg.—Bright sunshine 222·2 hours.

Mauritius.—Mean temp. of air 0°·3, and R 6·39 in., below averages. Mean hourly velocity of wind 10·2 miles or 0·2 miles below average.

COLOMBO.—Mean temp. of air 81°·0 or 0°·5 below, of dew point 1°·2 above, and R 4·56 in. above, averages. Mean velocity of wind 3·5 miles per hour. TSS on 9 days.

HONGKONG.—Mean temp. of air 61°·7. Mean hourly velocity of wind 14·5 miles. Bright sunshine 96·7 hours.

Sydney.—R 3·68 in. above, temp. of air 0°·6 above, averages.

Melbourne.—Mean temp. of air 2°·5 below, and R 2·96 in. above, averages.

Adelaide.—Mean temp. of air 1°·5 below, and R 1·14 in. above, averages.

Perth.—Temp. 0°·8 below, and R 1·19 in. below, averages.

Hobart.—Mean temp. of air 2°·7 below, and R 2·26 in. above, averages.

Wellington.—Mean temp. of air 0°·8 above, and R 6·63 in. below, averages. Bright sunshine 170·2 hours.

# Symons's Meteorological Magazine.

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## FROM THE EDITOR

### To the Readers of "Symons's Meteorological Magazine."

AFTER editing this Magazine for nearly thirteen years I am now faced with the necessity of taking a lengthened leave of absence on account of a breakdown of my eyesight, the result of continued overstrain; and although I leave home with every prospect of being able to resume work on my return within a year, I feel that it is my duty to appoint a temporary Acting-Editor. I am happy that my old friend, Mr. R. C. Mossman, has consented to take this position, and that he will also be associated with Mr. Carle Salter, now Assistant Director of the British Rainfall Organization, in editing *British Rainfall* and carrying on the rest of my work as Director of the Organization for the time.

Mr. Mossman has been a Meteorological Observer for more than twenty-five years, having like myself had the benefit of the late Dr. Alexander Buchan's advice and instruction. He was frequently in residence at the Ben Nevis Observatory, and in 1901 and 1902 kept up a series of very interesting comparative observations in Glen Nevis, which were published monthly in this Magazine for five months. When Dr. W. S. Bruce equipped the Scottish Antarctic Expedition in 1902, Mr. Mossman was appointed Meteorologist, and accompanied the *Scotia* on her cruise to Weddell Sea. He was landed on Laurie Island in the South Orkneys, where he established a first order meteorological station, of which he remained in charge for two years. After some time spent at home in working up the Antarctic data, he, in 1907, entered the service of the Argentine Meteorological Office in Buenos Aires, where his special duty was the editorship of the Volumes of Records.

Mr. Mossman's exhaustive discussions of the Climate of Edinburgh and the Climate of London, and his more recent investigations into the Correlations of Meteorological Phenomena in the Southern Hemisphere, are well known to our readers, and form an ample guarantee of his fitness for the work he has undertaken.

The principal ingredient in the prescription of my medical advisers is "a mind free from worry," and this I believe has been successfully dispensed by combining the intimate knowledge of the working of the British Rainfall Organization possessed by Mr. Salter with the great experience and wide outlook over the meteorological horizon of Mr. Mossman.

## THE METEOROLOGICAL LUNCHEON.

(British Association, Birmingham, 1913.)

By E. GOLD, M.A.

METEOROLOGISTS and other Cosmical Physicists met at the Grand Hotel on Monday, September 15th, after a morning devoted to the discussion of papers on Cosmical Physics. Prof. H. N. Dickson, President of Section E, Geography, and past President of the Royal Meteorological Society, presided over the company, which included the following representatives from overseas: Mr. C. E. St. John, of Mount Wilson Solar Observatory, U.S.A.; Mr. R. C. Mossman, of the Argentine Meteorological Service; Mr. B. F. E. Keeling, of the Egyptian Survey Department; and, representing local meteorology, Mr. J. H. Reynolds, Vice-President of the Birmingham and Midland Institute.

The following is a full list of those present:—

|                             |                             |
|-----------------------------|-----------------------------|
| Mr. J. S. Amery.            | Mr. A. Pearse Jenkin.       |
| Mr. T. W. Backhouse.        | Capt. H. G. Lyons, F.R.S.   |
| Mr. Richard M. Barrington.  | Mr. F. K. McClean.          |
| Prof. H. Bassett.           | Dr. J. R. Milne.            |
| Mr. F. A. Bellamy.          | Mr. R. C. Mossman.          |
| Miss E. F. B. Bellamy.      | Mrs. Mossman.               |
| Dr. H. Borns.               | Mr. T. S. Muir.             |
| Dr. W. S. Bruce.            | Dr. F. G. Ogilvie, C.B.     |
| Mrs. Bruce.                 | Mr. A. G. Ogilvie.          |
| Dr. S. Chapman.             | Prof. J. E. Petavel, F.R.S. |
| Prof. H. N. Dickson.        | Dr. A. O. Rankine.          |
| Prof. W. G. Duffield.       | Col. H. E. Rawson, C.B.     |
| Prof. A. S. Eddington.      | Mr. J. H. Reynolds.         |
| Mr. M. McCullum Fairgrieve. | Mrs. Reynolds.              |
| Mr. E. Gold.                | Mr. W. S. Rolston.          |
| Mrs. Gold.                  | Mr. C. E. St. John.         |
| Mr. H. R. Hassé.            | Dr. G. H. Shakespear.       |
| Prof. A. J. Herbertson.     | Mr. L. Southern.            |
| Dr. H. B. Heywood.          | Prof. H. H. Turner, F.R.S.  |
| Mrs. Heywood.               | Miss Margaret White.        |
| Mr. B. F. E. Keeling.       | Mr. J. Woodrow.             |

Prof. H. H. Turner proposed the toast of "The Foreign Guests," mentioning especially Mr. St. John, Mr. Keeling and Mr. Mossman. Mr. St. John had shown to us some of the wonderful results which had been obtained at Prof. Hale's Observatory on Mount Wilson, an observatory specially erected to investigate the sun and the physics of the sun, with which meteorology and the physics of the atmosphere were inseparably connected. Mr. Keeling, who could hardly be called a foreigner, represented the Survey Department of Egypt, which had to deal with meteorological investigations and applications, in a country which depended in a simple and direct manner upon the annual recurrence of an exceptional meteorological phenomenon.

Mr. Mossman had shown in the discussion that morning how alert meteorologists in the Argentine Republic were to take account of the most recent and powerful methods of investigating the problem of seasonal forecasts.

Mr. St. John expressed his appreciation of the kind words in which Prof. Turner had referred to his work. He had at first wondered why he had been invited to a "meteorological" luncheon, since his investigations had been mainly concerned with the solar atmosphere ; but when he recollected the important investigations of Mr. C. G. Abbott, by simultaneous observations of solar radiation in America and Algeria, he realised the appropriateness of a solar physicist attending a "meteorological" luncheon. He referred to the monastic isolation of the observatory on Mount Wilson, and the pleasure of remembering and relating to his colleagues there the cordial and kindly things which he had heard.

Mr. Keeling referred briefly to his official work in Egypt, and expressed his thanks for the kind reference which Prof. Turner had made to him.

Mr. Mossman said how glad he was to be present at that gathering. He had been six years in the Argentine, where he met few meteorologists, and the pleasure of renewing now his intercourse with meteorologists in England could hardly be understood by those who were constantly meeting one another. He referred to the re-organisation of the meteorological services of the different states of South America, which were advancing towards the closer co-operation essential for progress in meteorology. He hoped to take further the investigations in correlation to which reference had been made, but he expected to have a busy year in England in carrying on, in conjunction with Mr. Salter, the work of Dr. H. R. Mill, who was taking a year's leave from British Rainfall.

Prof. Dickson proposed the toast of "Local Climate" and the "local observatory," coupled with the name of Mr. J. H. Reynolds, who was Vice-President of the Midland Institute, under whose auspices regular meteorological records had been taken for many years. They had all had an opportunity of seeing in the Handbook some of the results of those records ; in particular how Birmingham had about 200 hours less than its share of bright sunshine every year, and how it rarely had as much as one inch of rain in a day ; possibly the outpouring, which had come with such appropriateness that morning, had been an effort on the part of the local weather to break a record in their honour.

Mr. Reynolds, in returning thanks, said that although his personal interest was chiefly in things astronomical, he was very anxious that the reputation of the local meteorological observatory should not only be maintained, but should be improved ; records had now been kept for over 20 years, and the citizens of Birmingham were beginning to realise how the continued outpouring of smoke deprived them of what was best in meteorology—viz., sunshine.

## SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

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

(of the Argentine Meteorological Office).

## Fifth Article.

## CORRELATIONS AT ST. HELENA.

ALTHOUGH St. Helena is not located in an "action centre," the observations from this island are of considerable interest, inasmuch as they are influenced by and are an index of the intensity of the S.E. Trades. Although considerable time and labour have been expended in a search for correlations between St. Helena and places in the two hemispheres, the results so far cannot be looked upon as conclusive, owing to the relatively short period covered by the St. Helena record. Some suggestive resemblances and contrasts have however shown up, which will be briefly referred to.

During the 11 years 1893 to 1903 there was an undoubted relation between the quantity of rainfall over a wet district in the vicinity of Fort William during the period, January to March, and the mean temperature at St. Helena for the four months, May to August,

## RAINFALL IN SCOTLAND, WEST (JAN. TO MAR.) AND TEMPERATURE AT ST. HELENA (MAY TO AUG. FOLLOWING)

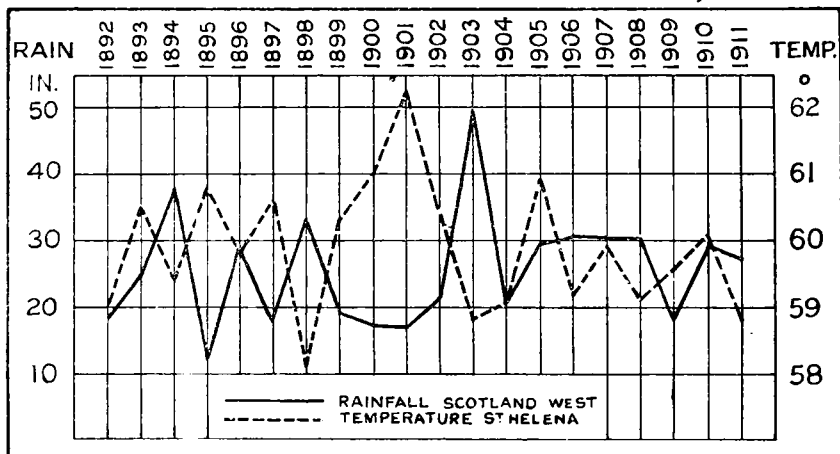


Fig. 1.

following. The district rainfall mean for Scotland west is the average of the five stations, Glenquoich, Invergarry, Bendamph, Glencarron and Fort William, the data being extracted from the *Journals of the Scot. Met. Soc.*, while the St. Helena mean temperature is from the publication *M.O. 203*, supplemented by later data kindly forwarded by Dr. Shaw.

From 1904 to 1911 the correlation breaks down, both the rainfall and the temperature data showing little fluctuation from one year to another as compared with the 11 years preceding.

*Rainfall, Scotland West, January to March, and Mean Temperature, St. Helena, May to August following.*

|                                             | 1892 | 1893 | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 | 1901      |
|---------------------------------------------|------|------|------|------|------|------|------|------|------|-----------|
| RAIN, Scotland W.,<br>Jan. to March .....   | 18.4 | 24.9 | 37.8 | 12.4 | 29.6 | 18.4 | 33.5 | 19.6 | 17.4 | 16.9      |
| TEMP., St. Helena,<br>May to Aug. following | 59.0 | 60.5 | 59.4 | 60.8 | 59.8 | 60.6 | 58.1 | 60.3 | 61.0 | 62.2      |
|                                             | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911      |
| RAIN .....                                  | 21.7 | 49.3 | 26.5 | 29.8 | 30.9 | 30.5 | 30.2 | 18.6 | 29.1 | 27.5      |
| TEMP.....                                   | 60.4 | 58.8 | 59.1 | 60.9 | 59.2 | 59.9 | 59.1 | 59.6 | 60.1 | 58.8      |
|                                             |      |      |      |      |      |      |      |      |      | Mean.     |
|                                             |      |      |      |      |      |      |      |      |      | 25.8 in.  |
|                                             |      |      |      |      |      |      |      |      |      | 59.9 deg. |

*Departure from Normal.*

|                       | 1892 | 1893  | 1894  | 1895  | 1896 | 1897 | 1898 | 1899 | 1900 | 1901      |
|-----------------------|------|-------|-------|-------|------|------|------|------|------|-----------|
| RAIN, Scotland W. ... | -7.4 | -9    | +12.0 | -13.4 | +3.8 | -7.4 | +7.7 | -6.2 | -8.4 | -8.9      |
| TEMP., St. Helena ... | -.9  | +.6   | -.5   | +.9   | -.1  | +.7  | -1.8 | +.4  | +1.1 | +2.3      |
|                       | 1902 | 1903  | 1904  | 1905  | 1906 | 1907 | 1908 | 1909 | 1910 | 1911      |
| RAIN .....            | -4.1 | +23.5 | -5.3  | +4.0  | +5.1 | +4.7 | +4.4 | -7.2 | +3.3 | +1.7 in.  |
| TEMP.....             | +.5  | -1.1  | -.8   | +1.0  | -.7  | .0   | -.8  | -.3  | +.2  | -1.1 deg. |

The data discussed are for the 20 years, 1892 to 1911, and are given in the preceding table, the actual values being shown in Fig. 1.

A relation can be traced between the mean temperature at St. Helena during the four months, January to April, and the mean

TEMPERATURE AT ST. HELENA (JAN. TO APRIL) AND MEAN PRESSURE AT PUNTA ARENAS (MAY TO AUG. FOLLOWING)

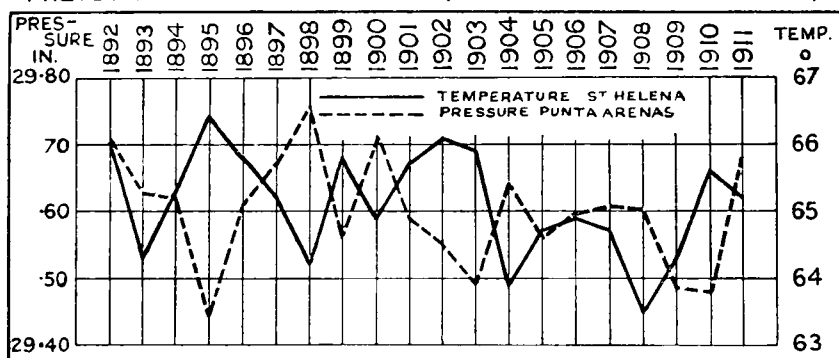


Fig. 2.

barometric pressure at Punta Arenas, in Magellan Straits, during the four months following. This relation is shown by the circumstance that if the January to April temperature at St. Helena shows a rise as compared with the year previous, the pressure at Punta Arenas during the period, May to August, in general shows a fall, and *vice versa*. During the last six years, 1906 to 1911, of the period discussed the results are not very conclusive, this being probably due

to the position occupied by Punta Arenas, which is in some groups of years dominated by Atlantic and in other periods by Pacific influences. The mean temperature and pressure values are as follows :—

|                            |      |      |      |      |      |      |      |      |      |      |
|----------------------------|------|------|------|------|------|------|------|------|------|------|
| TEMP., St. Helena,         | 1892 | 1893 | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 | 1901 |
| Jan. to April .....        | 66.0 | 64.3 | 65.3 | 66.4 | 65.8 | 65.2 | 64.2 | 65.8 | 64.9 | 65.7 |
| PRESSURE, Punta Arenas,    |      |      |      |      |      |      |      |      |      |      |
| May to August ... 29 in. + | .71  | .63  | .62  | .44  | .61  | .67  | .76  | .56  | .71  | .59  |

|             |      |      |      |      |      |      |      |      |      |      |           |
|-------------|------|------|------|------|------|------|------|------|------|------|-----------|
|             | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | Mean.     |
| TEMP. ....  | 66.1 | 65.9 | 63.9 | 64.7 | 64.9 | 64.7 | 63.5 | 64.3 | 65.6 | 65.2 | 65.1 deg. |
| PRESSURE... | .55  | .49  | .64  | .56  | .60  | .61  | .60  | .49  | .48  | .68  | 29.60 in. |

Fig. 2 shows the above data in graphic form.

The majority of correlations which break down do so completely, passing into an indefinite type, in which the characteristic phases of

#### TEMPERATURE AT ST HELENA AND RAINFALL AT MEXICO CITY MAY TO AUGUST

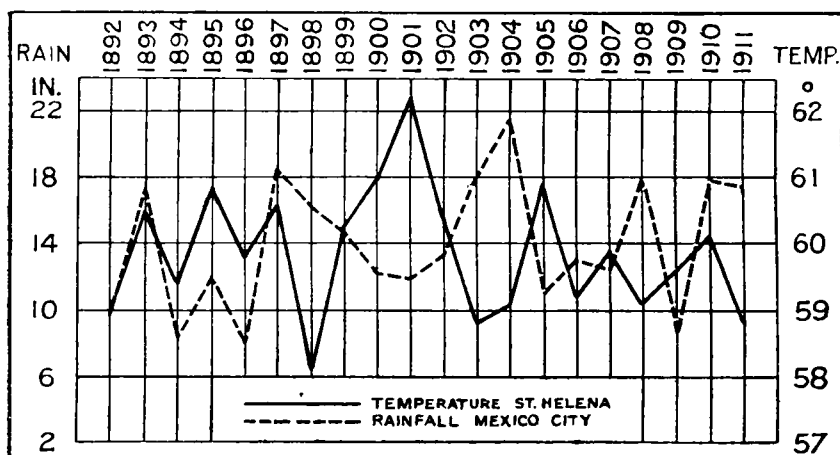


Fig. 3.

the curves are sporadically mixed up with cases of complete disagreement. Sometimes, however, a correlation which for some years may be of a positive nature, changes suddenly into one of a negative character, which may persist for some years. An example of this is shown by a comparison of the May to August rainfall at Valle de Mexico, lat.  $19^{\circ} 26' N.$ , long.  $99^{\circ} 08' W.$ , height 7,480 feet, with the mean St. Helena temperature for the same months. The St. Helena values have already appeared in this article, those referring to the Mexico rainfall (extracted from the monthly bulletins of the Central Observatory) being as follows, in inches :—

|      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|
| 1892 | 1893 | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 | 1901 |
| 9.7  | 17.3 | 8.3  | 13.0 | 8.1  | 18.6 | 15.4 | 14.6 | 12.2 | 12.0 |
| 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 |
| 13.4 | 18.0 | 21.6 | 11.2 | 13.1 | 12.5 | 17.9 | 8.7  | 17.8 | 17.6 |

In this case we find the two curves (see Fig. 3) pursuing the same course from 1892 to 1898, while from 1899 to 1909 they were the reverse of each other, coming into agreement again in 1910 and 1911.

Somewhat similar results are shown from a comparison of the January barometric pressure curves at Ponta Delgado, Azores, and Punta Arenas during the 24 years, 1889—1912. For the 13 years, 1892—1904, the departures from the normal for the two places were the opposite in 11 years and the same in two years, while in the five years succeeding (1905 to 1909), the departures from the normal were positive at both places.

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## Correspondence.

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

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### THE GENESIS OF DEW.

DURING the course of the last year or so I have been much struck by the circumstance that the amount of "dew on the grass" in the early morning, just before or about the time of sunrise, does not bear any traceable relationship either to the indicated humidity of the atmosphere or to the temperature indicated by the "grass thermometer." I am using a set of three shallow thin glass trays 8 in. by 6 in. One is set on the grass hollow side up. Into this is precipitated what I judge to be moisture from the atmosphere. Another is inverted on the grass close to the first. On the underside I find condensed moisture that has evidently exhaled as vapour from the herbage and the soil. The third is inverted on a bare patch of garden soil near by. On the underside of this I, sometimes, find moisture that has risen as vapour from the earth. It is an easy matter to take off these deposits either by means of a bit of soft sponge or blotting paper, and get the nett value with a set of photographer's grain scales. Thus treated so far, elementary arithmetic makes apparent that about sixty per cent. of a given dew deposit is exhaled by the grass, some twenty-five per cent. is precipitated from the atmosphere, and vapour from the soil is accountable for the remainder.

Of course such evidence is merely suggestive, but so far I have not met with any other analysis of the genesis of dew. Is there any authoritative pronouncement on the subject?

WILLIAM GODDEN.

20, Richmond Avenue, Willesden, N.W., 30th July, 1913.



## THE CLIMATE OF TORQUAY.

MR. MACDOWALL, in criticizing my note of June 22, drags in five other towns which have no more to do with the subject—a comparison of the summer and winter climates of Torquay—than have Calcutta or Moscow. Into any comparison whatever of the respective merits or demerits of those rival health resorts I must decline to be led.

But I maintain my opinion that the winter climate of Torquay is immensely over-rated, and its summer climate hardly less maligned. My personal experience as a gardener, cultivating especially the light-loving orchids, is that recent winters here have been remarkably sunless. The winter gales have impressed themselves upon my memory by damage done to fine conifers planted here some 70 years ago by Mr. Isambard Brunel. But when I turn to the words "terribly wet," I can supply figures. The rainfall of the three winter months (December, January and February) for the four years (1909–1913) during which I have taken observations has been 16·56 in., 11·30 in., 19·55 in., and 15·43 in., giving a total of 62·84 in., and an average per quarter of 15·71 in., or per month, 5·24 in. "Whitaker," in his Almanack, gives the average rainfall (at Greenwich, I presume) for every month for 50 years, 1841–1890. For those three months he makes it out 5·24 in., or per month, 1·75 in.

I was, however, discussing the Torquay winters not absolutely, but in relation to its summers. I have always heard July and August spoken of as the wettest months of the year, so I was not surprised to find that the average of June, July and August given in "Whitaker," mounts up to 6·84 in., average per month, 2·28 in.

The June, July and August rainfall here for the aforesaid four years has been 10·12 in., 3·66 in., 13·32 in., and 1·66 in., in all 28·76 in., giving an average of 7·19 in. for the three months, and 2·39 in. per month.

Roughly speaking, then, *three times as much rain* falls here during the three winter months as does at the place (? Greenwich) whence "Whitaker" derives the figures which he uses as his standard. On the other hand, in the summer, very slightly more rain falls here than there. I think that my words "terribly wet" are abundantly justified. We have a large rainfall, and it falls mostly in the winter months.

Your Correspondent takes no exception to my remarks as to Torquay summers, but I should like to be permitted to say that, while I find in "Whitaker" maxima of 90° or over recorded seven times—once, on August 9th, 100°—in the phenomenal summer of 1911, here upon one occasion only did the shade temperature rise as high as 86½°. Of the hot oppressive airless nights with which one meets so often during a London summer, and occasionally in the Thames Valley, I can only remember one during the seven summers I have spent in Torquay.

JOHN EDWARDS-MOSS.

*Roby Hall, Torquay, 30th September, 1913.*

## THUNDERSTORM OF SEPTEMBER 16th AT NEWCASTLE-ON-TYNE.

THE following notes upon a thunderstorm we had in this district may be of some interest.

Following a light shower in the early morning, and a slight thunderstorm at about 5 o'clock, the morning broke dull and threatening, when a torrential shower fell from 8.15 a.m. till 8.45, but not until 9 o'clock was there any indication of the coming storm. At the hour mentioned huge banks of ominous looking clouds rolled up from the west, and for about half an hour thunder, followed by lightning, was noted in the distance; this gradually approached nearer until 10 o'clock, when what can be described as nothing short of a waterspout burst. Tropical rain had fallen from 9 o'clock, and continued until about 11 o'clock, when suddenly the storm ceased and the sun shone brilliantly.

Nearly every street was rendered impassable by the roaring torrents, which rushed everywhere, and caused a considerable amount of damage. As regards the amount of the precipitation, about .75 in. had fallen at 9 o'clock, and during the 2 hours the storm lasted, 2.53 in. fell, about 2 in. having fallen in  $1\frac{1}{4}$  hours. There was no further fall of rain, so that my record for the 16th was 3.28 in., the heaviest fall of rain during 24 hours during any month I have in my records, which cover 20 years, and never during this period has an inch of rain fallen in September, nor has 3 inches been recorded during the whole month.

An extraordinary fact was that the fall of the barometer before the storm was extremely small, thus indicating a very shallow depression. The storm was only local, and appears to have been severest here.

L. J. NICHOLSON.

*Woodbine Road, Gosforth, Newcastle-upon-Tyne, 22nd Sept., 1913.*

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You will perhaps wish to have some idea of the limitations of the cloudburst at Newcastle on the 16th, so I send you the rainfall as measured here about that time. There has been nothing noticeable here, but I am told that at Hawthorn and Haswell, about 8 or 10 miles south of this, there was very heavy rain at or near the same time as in Newcastle. The rain here is measured at 8 a.m. and put down to the preceding day. During the 11 days ending with the 22nd, 0.63 in. fell, and on the 16th only .01 in. T. W. BACKHOUSE.

*West Hendon House, Sunderland, 23rd Sept., 1913.*

[Such severe thunderstorms occur several times every year in some part of England, although rarely twice in the same place within half a century. We cannot, however, approve the use of the word *waterspout* for any rainfall which can be measured, as a *waterspout* or *cloud-burst* must inevitably wash away any rain gauge on which it falls.—Ed., S.M.M.]

## THE WEATHER OF SEPTEMBER.

DURING the first ten days of the month anti-cyclonic conditions predominated. Rainfall was most unequally distributed during the first week, none falling in the west of Scotland and north-west of England, while in the south-east of England the week's fall amounted to nearly four times the normal. During this time temperature over the greater part of the country was in excess of the normal, but in the east and north of Scotland there was a marked deficit, shade minima as low as  $34^{\circ}$  being recorded at Balmoral on the 5th, and  $35^{\circ}$  at Gordon Castle on the 6th. At Newton Rigg on the 6th temperature fell to  $36^{\circ}$ , but over nearly the whole of England relatively high minima were observed. On the 11th a large, and for the season, deep disturbance whose centre lay between Iceland and Greenland, caused strong winds or moderate gales in the north of Scotland and west of Ireland. Temperature in Ireland was high, the maxima for the month being very generally recorded on the 11th, when a value of  $73^{\circ}$  was recorded at Roche's Point and  $72^{\circ}$  at Killarney. On the 13th a shallow depression suddenly developed over South Wales and the south-west of England. On the morning of the 14th pressure had fallen as low as 29.1 in. at Holyhead, and a N.N.E. gale was blowing at Malin Head. Heavy rains fell over most of England and Ireland, as much as 2.2 in. at Ennistymon (Co. Clare) and 1.6 in. at Enniscoe. On the 16th a remarkably heavy thunderstorm rain was experienced at Newcastle, 2.65 in. falling in one hour and a half. This was an essentially local rainfall extending over a very small area, and it is of interest to note that a somewhat similar fall occurred to the east and south of Doncaster on the following day, when Wath-on-Dearne recorded 2.4 in. and Bantry 2.1 in. These two falls are clearly shown by the course of the isohyets on the September map, forming perhaps the most noteworthy departures from the normal of the month for any portion of the British Isles.

During the week ending the 27th unusually warm weather for the time of year was experienced with maxima as high as  $79^{\circ}$  in various parts of the Midlands, and in the north-east and north-west of England. Throughout this week the nocturnal temperature was exceptionally elevated, minima exceeding  $60^{\circ}$  being frequently recorded in the south-west of England and Channel Islands. At Totland Bay (Isle of Wight) on the 27th, and at Jersey on the 27th and 28th the temperature did not fall below  $62^{\circ}$ . Southerly winds prevailed during the week under review. On the 28th temperature fell over the midland counties and southern England, the fall becoming general on the 29th, the month closed with fair or fine weather over the country.

The general rainfall expressed as a percentage of the average was : England and Wales, 94 ; Scotland, 77 ; Ireland, 119 ; British Isles, 96.

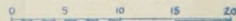
# THAMES VALLEY RAINFALL - SEPTEMBER, 1913.



ALTITUDE  
SCALE

|                |                 |                  |                 |
|----------------|-----------------|------------------|-----------------|
| Below 250 feet | 250 to 500 feet | 500 to 1000 feet | Above 1000 feet |
|----------------|-----------------|------------------|-----------------|

SCALE OF MILES







## WEATHER FALLACIES.

By A. O. WALKER, F.L.S.

THE experience gained in over 40 years of observing and making daily records of weather phenomena emboldens the writer to offer the following notes. Obviously the subject to attack first is that of

**Weather Forecasts,**

by which is meant those supplied by the Meteorological Office to the daily Press. These, of course, are based on the movements of cyclones and anticyclones (areas of low and high barometric pressure) which affect the weather of the British Islands. But before going further the writer desires to say that the criticisms he has to make on the forecasts are not intended to imply any censure on the above Office, whose staff is doubtless fully aware of defects which, in the present state of the science of Meteorology, are inevitable; also, that he writes from the point of view of an agriculturist.

At the last meeting of the British Association, on September 9th, 1912, an interesting discussion took place on "the Application of Meteorological Information to Agricultural Practice," in which Dr. Shaw is reported to have said "it was time to ask if the forecasts were useful and if they were used as they might be." Now, before attempting to answer this very sensible question, let it be understood that, practically, rain is the only item of any importance to the farmer. When a field of hay is ready to cut it is useless for the owner to look at any available forecast, because what he wants to know is not the weather of to-day when he has to make up his mind whether he will cut it to-morrow or not, or even of to-morrow (for rain does very little harm to hay until it has been turned), but whether he can have fine weather two or three days *after he has cut*; and as this information cannot be had, the best thing he can do is to cut when the hay is ripe and take his chance like his forefathers. The writer in 1906 had 1·02 in. of rain on his hay in the first two days (Thursday and Friday) after it was cut and before it was turned, and stacked it in excellent condition the following Wednesday!

If the forecast of rain could be got in time to allow of sowing before it fell and *if it could be localized*, it would indeed be useful, but, alas! there seems very little chance of either of these conditions being fulfilled! Thunderstorms, cloud-bursts, and "local showers" will continue to show themselves independent of all the calculations of meteorologists so far as the exact locality of their discharge is concerned, and until this difficulty is overcome forecasts are useless to farmers.

And if it were overcome, what then? To foretell is not to prevent, and we should still have wet summers, and bad harvests, the effects of which would be but little mitigated by fore-knowledge, which could probably only be obtained at a cost out of all proportion to the results. And it seems a pity that men of science should have to

waste their time in trying to do the impossible when there is so much to be done in the purely scientific problems of meteorology. Possibly they agree with this, but issue the forecasts under the impression that the ignorant public thinks that it gets "something for its money," whereas 99 out of 100 don't think of them at all.

The following examples well illustrate the difficulties of making accurate rainfall forecasts :—

1. On September 7th, 1910, during the prevalence of an immense anticyclone, a rainstorm passed across the north of Kent from the North Sea as far as Ulcombe, where the fall (0·74 in.) was the heaviest of the year up to the above date. To the south of Ulcombe it could not be traced ; no rain fell at Hastings, and the *total* rainfall for September at Tenterden was only 0·48 in. on 10 days. There was no thunder or lightning (*Symons's Met. Mag.*, 1910, p. 191).

2. From June 1st to 11th, 1911, no rain was recorded at Ulcombe. At Sharsted Court, only 8½ miles distant (N.E.), it rained every day from 1st to 10th, the amount being 2·02 in. ! Yet the one forecast applies to both places !

#### Rainfall.

What is a wet year ? From the point of view of the man who is interested in the water-supply of the country it is a year in which the rainfall is above the average. But to the farmer (unless his land is liable to floods), and to the great majority of people, it means a year in which there is an excessive number of rainy days. Take the case of the 1·02 in. of rain mentioned in a previous page as falling on a crop of hay just cut without injury to it—had half that quantity been distributed over the following 10 days the value of the hay would have been very seriously reduced, while the cost of getting it would have been very greatly increased. It may be thought that these two items must generally coincide, but this is by no means the case. Last year (1912), for instance, the total rainfall here was 28·88 in. against 34·81 in. in 1903. But while in 1912 it rained on 192 days, in 1903 it only rained on 172 ! Yet much less importance is generally attached to the number of days than to the amount of rain—indeed, many of the contributors of *British Rainfall* do not think it worth while to take daily measurements.

The effect of neglecting the number of rain days is even more misleading in the monthly rainfall than in the annual. Take the case of September, 1912 : the rainfall at Ulcombe for the month was ·83 in. above the average of 10 years, so that one would suppose it to have been a rather wet month. Yet, on the contrary, it was a remarkably dry one, only ·26 in. having fallen before the 29th, on which day and the next 2·21 in. fell ! And it was fortunate that it was dry, for the previous month was the wettest August as regards both amount of rain (5·71 in.) and number of days of rain (28) ever recorded by the writer in 32 years, of which 19 were in N. Wales. Indeed the number of days exceeded by 2 the highest recorded in that period for *any* month !

### Averages.

These are regarded by most climatologists with an almost superstitious veneration! It is certainly convenient, when asked which are the driest and wettest months, to give the averages of a certain number of years, and both the giver and receiver are satisfied. But their satisfaction would be less if they went into the items from which the averages were deduced. For instance, in the ten years 1900-9 February has the lowest\* average of 1.62 in., and October the highest of 3.10 in. But on looking into the items we find that in those years the February rainfall ranges from .88 in. in 1909 to 3.75 in. in 1900, while October ranges from 1.66 in. in 1908 to 5.29 in. in 1903. And in 1900 the two months had changed places, October with a rainfall of 1.76 in. being the driest, and February with 3.75 in. the wettest month of the year! It is very clear, therefore, that in making arrangements, say for one's holidays, it will not do to rely on monthly rainfall averages.

Yearly averages are more useful, especially in comparing the rainfall of different localities. But here again, the average number of rain days would be, as shown above, at least as useful as that of the rainfall, yet it is very rarely given. A person looking for an agreeable climate would probably prefer one with fewer rain days and more rainfall to the reverse of these conditions. To take an example at a venture to show how the proportions of the two vary, we find in *British Rainfall, 1911*, p. [342], in two apparently not distant localities the following figures: 29.86 in. on 181 days, 41.36 in. on 166 days.

### Temperature.

This is generally published in the form of the highest (max.) lowest (min.) in the Stevenson screen, and their "means" or averages obtained by adding together all the readings for a given month and dividing the total in each case by the number of days in the month. The mean temperature is arrived at by adding the mean max. to the mean min. and halving the result. Of the above it is worth observing that in hot weather, with the sun shining for hours on the screen, the temperature inside, owing to radiation from the heated wood, is considerably higher than it is in an open verandah facing north. Thus, on August 9th, 1911, at 2 p.m., the maximum thermometer and a control mercurial one in the screen stood at 95°.5, while a previously compared mercurial in a N. verandah, about 20 yards distant, at the same time stood at 88° only. This was confirmed on September 12th, the respective temperatures being 86° and 79°; at 9.20 p.m. the same evening both stood at 70°.5. To prove the heating of the wood, on July 14th, 1912, at 6.30 p.m., a thermometer on the back of the screen (inside) stood at 81°, while on the usual frame in the middle the temperature was 75°. As, however, it is necessary to have observations for comparison taken under

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\* "February Fillydike"!! So much for popular beliefs.



uniform conditions, and the Stevenson screen has been generally adopted, this source of error cannot be avoided, but should be allowed for.

Monthly mean temperatures are apt to be very misleading. A cold or warm spell may begin near the end of one month and continue over the first few days of the next, the mean max. or min. of each month giving little idea of the intensity of the spell, so that a gardener wishing to compare one summer with another in regard to periods hot enough to ripen the wood of his fruit trees might easily be misled by the published means. The means of all important periods of heat or cold, irrespective of the calendar, ought to be published in an easily accessible form.

It is difficult to see the use of the "mean temperature" (see above), as it gives no information by itself of the climate of the locality.

Compare the following :—

Coolgardie, W. Australia,  
Oct., 1910.\*  
Mean max. =  $71^{\circ}\cdot9$   
,, min. =  $46^{\circ}\cdot6$   
,, temp. =  $59^{\circ}\cdot3$

Dwyran, N. Wales,  
July, 1912.†  
Mean max. =  $65^{\circ}\cdot5$   
,, min. =  $53^{\circ}\cdot6$   
,, temp. =  $59^{\circ}\cdot6$

So that, with practically the same mean temperature, there is a difference between max. and min. of  $25^{\circ}$  in the one and only  $12^{\circ}$  in the other ! And what different climates !

(To be continued.)

## REVIEW.

*The Realm of Nature, an outline of Physiography*, by HUGH ROBERT MILL, D.Sc., LL.D. London : John Murray, 1913. Size  $7\frac{1}{2} \times 5$ . Pp. xii. + 404, 19 plates. Price 5s.

THIS is a book that we cannot well review in these pages, but we may place its publication on record. The book was planned twenty-five years ago with the ambitious design of giving an outline of the scientific study of Nature on a uniform scale, and defining the limits of the various special sciences involved in studying the conditions and processes concerning the Earth as a whole. From time to time as the book was reprinted many alterations and corrections were introduced, and now a completely new edition has been prepared, large parts of the book being rewritten. The original scheme has been preserved—though we may hint to our readers that the author with the experience of another quarter of a century would not now dare to think so imperially on the whole of Nature.

The extent of the revision may be judged by the alterations on the page reproduced herewith. Most extension has been given to the treatment of meteorology.

\* *Symons's Meteorological Magazine*, Vol. 46, p. 60.

† *Monthly Weather Reports* of Meteor. Office, July, 1912, p. 72.

As much as 4 inches of rain may fall in a single day in any part of the British Isles, though such heavy falls are very rare indeed in the drier part of the country.

west and  
north of  
Scotland

the north of England and south of Scotland it is April, in the Scottish highlands it is May, and in Orkney it is June.

The average distribution of climate shown in the maps, although correct on the whole, cannot be depended upon to hold good at any special place for any particular month. Such maps are of great value in choosing a place to reside in, but of very little use for planning a pleasure trip.

The conditions of weather are somewhat complicated, but appear to depend mainly on the distribution of atmospheric pressures, which may be classified into certain well marked types.

~~of two, anticyclones.~~ An anticyclone is a portion of the atmosphere in which the pressure is highest at the centre, and diminishes nearly uniformly in all directions.

The wind in an anticyclone blows spirally outward, as is illustrated in the high-pressure regions shown in the Isobaric maps.

In the northern hemisphere the circulation of surface wind round the edge of an anticyclone is in the same direction as the hands of a watch move, in the southern hemisphere in the opposite direction, as explained by Ferrel's or Buys Ballot's Law.

An anticyclone when once formed is a very steady arrangement of pressure, and usually lasts for many days or even weeks at a time.

This being so, it is evident that a supply of air must be continuously renewed from above to take the place of that passing out as surface winds.

Air in fact passes through an anticyclone much as grain does through a pair of mill stones, though of course without suffering any physical change.

In the upper regions of the atmosphere air must be moving inward and sinking downward to maintain the anticyclone, and the pressure in the upper region of the atmosphere must thus be least above the spot where it is greatest on the Earth's surface.

This deduction has been proved to be true by observations at mountain meteorological stations.

The surface winds of an anticyclone are usually light and variable. As the air is descending from above, it contains very little water vapour, and no clouds are formed.

Hence in summer anticyclonic weather is brilliant, hot, and calm, with haze at night or heavy deposits of dew, on account of great cooling by radiation.

In winter an anticyclone is

frequently  
The sky is clear and so radiation is then unchecked, giving cold air and frost in winter, and a warm air with bright sunshine in summer, are frequent though not invariable occurrences.

## RAINFALL TABLE FOR SEPTEMBER, 1913.

| 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. | 1913.<br>in. |
| Camden Square.....                   | London.....          | 51 32      | 0 8                  | 111                            | 2'00                           | 1'75         |
| Tenterden.....                       | Kent.....            | 51 4       | *0 41                | 190                            | 2'25                           | 1'51         |
| Arundel (Patching).....              | Sussex.....          | 50 51      | 0 27                 | 130                            | 2'58                           | 3'05         |
| Fawley (Cadland).....                | Hampshire.....       | 50 50      | 1 22                 | 52                             | 2'60                           | 2'91         |
| Oxford (Magdalen College).....       | Oxfordshire.....     | 51 45      | 1 15                 | 186                            | 1'98                           | 1'45         |
| Wellingborough (Croyland Abbey)..... | Northampton.....     | 52 18      | 0 41                 | 174                            | 2'14                           | 1'49         |
| Shoeburyness.....                    | Essex.....           | 51 31      | *0 48                | 13                             | 1'70                           | '83          |
| Bury St. Edmunds (Westley).....      | Suffolk.....         | 52 15      | *0 40                | 226                            | 2'18                           | 2'50         |
| Geldeston [Beccles].....             | Norfolk.....         | 52 27      | *1 31                | 38                             | 2'13                           | 2'63         |
| Polapit Tamar [Launceston].....      | Devon.....           | 50 40      | 4 22                 | 315                            | 3'11                           | 2'87         |
| Rousdon [Lyme Regis].....            | „.....               | 50 41      | 3 0                  | 516                            | 2'69                           | 3'43         |
| Stroud (Upfield).....                | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 2'39                           | 2'56         |
| Church Stretton (Wolstaston).....    | Shropshire.....      | 52 35      | 2 48                 | 800                            | 2'40                           | 1'99         |
| Coventry (Kingswood).....            | Warwickshire.....    | 52 24      | 1 30                 | 340                            | 2'35                           | 1'72         |
| Boston.....                          | Lincolnshire.....    | 52 58      | 0 1                  | 11                             | 2'07                           | 1'75         |
| Worksop (Hodsock Priory).....        | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 1'84                           | 2'13         |
| Macclesfield.....                    | Cheshire.....        | 53 15      | 2 7                  | 501                            | 2'92                           | 1'30         |
| Southport (Hesketh Park).....        | Lancashire.....      | 53 38      | 2 59                 | 38                             | 3'09                           | 2'29         |
| Arncliffe Vicarage.....              | Yorkshire, W.R.....  | 54 8       | 2 6                  | 732                            | 4'55                           | 2'07         |
| Wetherby (Ribston Hall).....         | „.....               | 53 59      | 1 24                 | 130                            | 2'11                           | 1'22         |
| Hull (Pearson Park).....             | „ E.R.....           | 53 45      | 0 20                 | 6                              | 2'05                           | 1'05         |
| Newcastle (Town Moor).....           | Northumberland.....  | 54 59      | 1 38                 | 201                            | 2'00                           | 6'48         |
| Borrowdale (Seathwaite).....         | Cumberland.....      | 54 30      | 3 10                 | 423                            | 11'28                          | 4'56         |
| Cardiff (Ely).....                   | Glamorgan.....       | 51 29      | 3 13                 | 53                             | 3'61                           | 3'87         |
| Haverfordwest.....                   | Pembroke.....        | 51 48      | 4 58                 | 90                             | 3'91                           | 8'01         |
| Aberystwyth (Gogerddan).....         | Cardigan.....        | 52 26      | 4 1                  | 83                             | 3'89                           | 4'36         |
| Llandudno.....                       | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 2'50                           | 3'84         |
| Cargen [Dumfries].....               | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 3'34                           | 3'00         |
| Marchmont House.....                 | Berwick.....         | 55 44      | 2 24                 | 498                            | 2'67                           | 1'82         |
| Girvan (Pinnore).....                | Ayr.....             | 55 10      | 4 49                 | 207                            | 4'30                           | 3'16         |
| Glasgow (Queen's Park).....          | Renfrew.....         | 55 53      | 4 18                 | 144                            | 2'99                           | 2'18         |
| Inveraray (Newtown).....             | Argyll.....          | 56 14      | 5 4                  | 17                             | 6'15                           | 3'25         |
| Mull (Quinish).....                  | „.....               | 56 34      | 6 13                 | 35                             | 5'20                           | 3'11         |
| Dundee (Eastern Necropolis).....     | Forfar.....          | 56 28      | 2 57                 | 199                            | 2'34                           | 2'21         |
| Braemar.....                         | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | 2'73                           | 2'22         |
| Aberdeen (Cranford).....             | „.....               | 57 8       | 2 7                  | 120                            | 2'69                           | 2'55         |
| Cawdor.....                          | Nairn.....           | 57 31      | 3 57                 | 250                            | 2'55                           | 3'73         |
| Fort Augustus (S. Benedict's).....   | E. Inverness.....    | 57 9       | 4 41                 | 68                             | 3'54                           | 1'98         |
| Loch Torridon (Bendamph).....        | W. Ross.....         | 57 32      | 5 32                 | 20                             | 7'28                           | 4'19         |
| Dunrobin Castle.....                 | Sutherland.....      | 57 59      | 3 56                 | 14                             | 2'51                           | 2'88         |
| Wick.....                            | Caithness.....       | 58 26      | 3 6                  | 77                             | 2'57                           | 2'90         |
| Killarney (District Asylum).....     | Kerry.....           | 52 4       | 9 31                 | 178                            | 3'79                           | 4'79         |
| Waterford (Brook Lodge).....         | Waterford.....       | 52 15      | 7 7                  | 104                            | 3'19                           | 3'32         |
| Nenagh (Castle Lough).....           | Tipperary.....       | 52 54      | 8 24                 | 120                            | 3'16                           | 3'39         |
| Ennistymon House.....                | Clare.....           | 52 57      | 9 18                 | 37                             | 4'22                           | 5'56         |
| Gorey (Courtown House).....          | Wexford.....         | 52 40      | 6 13                 | 80                             | 2'78                           | 4'09         |
| Abbey Leix (Blandsfort).....         | Queen's County.....  | 52 56      | 7 17                 | 532                            | 2'93                           | 3'72         |
| Dublin (Fitz William Square).....    | Dublin.....          | 53 21      | 6 14                 | 54                             | 2'06                           | 4'31         |
| Mullingar (Belvedere).....           | Westmeath.....       | 53 29      | 7 22                 | 367                            | 3'02                           | 3'27         |
| Crossmolina (Enniscoe).....          | Mayo.....            | 54 4       | 9 16                 | 74                             | 4'42                           | 5'37         |
| Cong (The Glebe).....                | „.....               | 53 33      | 9 16                 | 112                            | 4'05                           | 3'76         |
| Collooney (Markree Obsy.).....       | Sligo.....           | 54 11      | 8 27                 | 127                            | 3'65                           | 3'03         |
| Seaforde.....                        | Down.....            | 54 19      | 5 50                 | 180                            | 3'25                           | 6'51         |
| Bushmills (Dundarave).....           | Antrim.....          | 55 12      | 6 30                 | 162                            | 3'49                           | 2'07         |
| Omagh (Edenfel).....                 | Tyrone.....          | 54 36      | 7 18                 | 280                            | 3'39                           | 3'24         |

RAINFALL TABLE FOR SEPTEMBER, 1913—*continued.*

| RAINFALL OF MONTH ( <i>con.</i> ) |          |                   |       |             | 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. in.  | 1913. in. | Diff. from Aver. in. | % of Av. |                        |                 |
|                                   |          | in.               | Date. |             |                       |           |                      |          | in.                    |                 |
| — .25                             | 88       | .46               | 16    | 11          | 17.92                 | 16.16     | —1.76                | 90       | 25.11                  | Camden Square   |
| — .74                             | 67       | .52               | 5     | 14          | 18.32                 | 17.03     | —1.29                | 93       | 27.64                  | Tenterden       |
| + .47                             | 118      | 1.43              | 4     | 11          | 20.02                 | 26.67     | +6.65                | 133      | 30.48                  | Patching        |
| + .31                             | 112      | .75               | 5     | 15          | 21.18                 | 22.50     | +1.42                | 107      | 31.87                  | Cadland         |
| — .53                             | 73       | .48               | 1     | 10          | 17.45                 | 14.40     | —3.05                | 82       | 24.58                  | Oxford          |
| — .65                             | 70       | .80               | 1     | 13          | 18.20                 | 16.11     | —2.09                | 88       | 25.17                  | Croyland Abbey  |
| — .87                             | 49       | .22               | 6     | 11          | 13.17                 | 11.69     | —1.48                | 89       | 19.28                  | Shoeburyness    |
| + .32                             | 115      | .68               | 1, 22 | 14          | 18.14                 | 16.45     | —1.69                | 91       | 25.40                  | Westley         |
| + .50                             | 123      | .63               | 17    | 18          | 16.33                 | 16.04     | — .29                | 98       | 23.73                  | Geldeston       |
| — .24                             | 92       | .65               | 16    | 15          | 24.90                 | 28.39     | +3.49                | 114      | 38.27                  | Polapit Tamar   |
| + .74                             | 127      | 1.12              | 5     | 12          | 22.54                 | 22.46     | — .08                | 100      | 33.54                  | Rousdon         |
| + .17                             | 107      | .89               | 1     | 12          | 21.12                 | 21.70     | + .58                | 103      | 29.81                  | Stroud          |
| — .41                             | 83       | .60               | 22    | 16          | 22.71                 | 25.63     | +2.92                | 113      | 32.41                  | Wolstaston      |
| — .63                             | 73       | .77               | 1     | 11          | 20.51                 | 19.08     | —1.43                | 93       | 28.98                  | Coventry        |
| — .32                             | 85       | .40               | 1     | 18          | 16.67                 | 14.22     | —2.45                | 85       | 23.35                  | Boston          |
| + .29                             | 116      | .94               | 17    | 12          | 17.54                 | 15.68     | —1.86                | 89       | 24.46                  | Hodsock Priory  |
| —1.62                             | 45       | .28               | 22    | 12          | 24.85                 | 23.67     | —1.18                | 95       | 34.73                  | Macclesfield    |
| — .80                             | 74       | .94               | 26    | 12          | 22.70                 | 20.88     | —1.82                | 92       | 32.70                  | Southport       |
| —2.48                             | 45       | .64               | 25    | 11          | 42.14                 | 41.24     | — .90                | 98       | 61.49                  | Arneliffe       |
| — .89                             | 58       | .43               | 18    | 11          | 19.08                 | 15.53     | —3.55                | 81       | 26.87                  | Ribston Hall    |
| —1.00                             | 51       | .38               | 1     | 11          | 18.57                 | 13.89     | —4.68                | 75       | 26.42                  | Hull            |
| +4.48                             | 324      | 2.65              | 16    | 20          | 19.65                 | 22.56     | +2.91                | 115      | 27.94                  | Newcastle       |
| —6.72                             | 40       | 1.05              | 13    | 13          | 88.04                 | 89.05     | +1.01                | 101      | 129.48                 | Seathwaite      |
| + .26                             | 107      | 1.26              | 4     | 13          | 28.63                 | 31.94     | +3.31                | 112      | 42.28                  | Cardiff         |
| +4.10                             | 205      | 2.06              | 13    | 13          | 30.96                 | 38.49     | +7.53                | 124      | 46.81                  | Haverfordwest   |
| + .47                             | 112      | .97               | 22    | 15          | 30.92                 | 41.52     | +10.60               | 134      | 45.46                  | Gogerddan       |
| +1.34                             | 154      | 1.45              | 12    | 15          | 20.55                 | 23.86     | +3.31                | 116      | 30.36                  | Llandudno       |
| — .34                             | 90       | .86               | 13    | 12          | 29.83                 | 34.32     | +4.49                | 115      | 43.47                  | Cargen          |
| — .85                             | 68       | .42               | 26    | 12          | 23.89                 | 19.58     | —4.31                | 82       | 33.76                  | Marchmont       |
| —1.14                             | 73       | .93               | 13    | 13          | 33.67                 | 30.28     | —3.39                | 90       | 49.77                  | Girvan          |
| — .81                             | 73       | .77               | 13    | 14          | 25.03                 | 24.77     | — .26                | 99       | 35.97                  | Glasgow         |
| —2.90                             | 53       | .95               | 25    | 13          | 46.21                 | 45.88     | — .33                | 99       | 68.67                  | Inveraray       |
| —2.09                             | 60       | .71               | 11    | 15          | 37.87                 | 35.26     | —2.61                | 93       | 56.57                  | Quinish         |
| — .13                             | 94       | .52               | 13    | 11          | 20.54                 | 18.63     | —1.91                | 91       | 28.64                  | Dundee          |
| — .51                             | 81       | .43               | 16    | 13          | 24.16                 | 24.17     | + .01                | 100      | 34.93                  | Braemar         |
| — .14                             | 95       | .95               | 13    | 13          | 22.78                 | 20.32     | —2.46                | 89       | 32.73                  | Aberdeen        |
| +1.18                             | 146      | 1.42              | 13    | 11          | 21.25                 | 16.83     | —4.42                | 79       | 29.33                  | Cawdor          |
| —1.56                             | 56       | .54               | 16    | 12          | 30.26                 | 29.06     | —1.20                | 96       | 44.53                  | Fort Augustus   |
| —3.09                             | 58       | 1.76              | 11    | 14          | 56.79                 | 52.62     | —4.17                | 93       | 83.93                  | Bendamph        |
| + .37                             | 115      | 1.40              | 15    | 8           | 22.41                 | 17.01     | —5.40                | 76       | 31.90                  | Dunrobin Castle |
| + .33                             | 113      | .81               | 15    | 15          | 20.68                 | 15.93     | —4.75                | 77       | 29.88                  | Wick            |
| +1.00                             | 126      | 1.35              | 14    | 19          | 36.76                 | 39.63     | +2.87                | 108      | 54.81                  | Killarney       |
| + .13                             | 104      | .92               | 22    | 15          | 27.45                 | 29.84     | +2.39                | 109      | 39.57                  | Waterford       |
| + .23                             | 107      | .75               | 24    | 18          | 27.73                 | 30.92     | +3.19                | 112      | 39.43                  | Castle Lough    |
| +1.34                             | 132      | 2.21              | 14    | 18          | 32.47                 | 35.66     | +3.19                | 110      | 46.52                  | Ennistymon      |
| +1.31                             | 147      | 1.13              | 22    | 16          | 24.41                 | 25.03     | + .62                | 103      | 34.99                  | Courtown Ho.    |
| + .79                             | 127      | .88               | 19    | 20          | 25.70                 | 29.50     | +3.80                | 115      | 35.92                  | Abbey Leix      |
| +2.25                             | 210      | 1.65              | 19    | 13          | 19.89                 | 20.98     | +1.09                | 105      | 27.68                  | Dublin          |
| + .25                             | 108      | .75               | 13    | 15          | 26.19                 | 28.55     | +2.36                | 109      | 36.15                  | Mullingar       |
| + .95                             | 122      | 1.62              | 14    | 16          | 35.74                 | 41.37     | +5.63                | 116      | 52.87                  | Ennisceoe       |
| — .29                             | 93       | 1.20              | 14    | 16          | 33.88                 | 36.63     | +2.75                | 108      | 48.90                  | Cong            |
| — .62                             | 83       | .70               | 14    | 14          | 30.14                 | 32.13     | +1.99                | 107      | 42.71                  | Markree         |
| +3.26                             | 200      | 2.04              | 13    | 13          | 27.63                 | 29.26     | +1.63                | 106      | 38.91                  | Seaforde        |
| —1.42                             | 59       | .54               | 14    | 15          | 26.32                 | 21.25     | —5.07                | 81       | 37.56                  | Dundarave       |
| — .15                             | 96       | .77               | 13    | 13          | 28.05                 | 29.16     | +1.11                | 104      | 39.38                  | Omagh           |

## SUPPLEMENTARY RAINFALL, SEPTEMBER, 1913.

| Div.  | STATION.                      | Rain<br>inches. | Div.   | STATION.                      | Rain<br>inches. |
|-------|-------------------------------|-----------------|--------|-------------------------------|-----------------|
| II.   | Warlingham, Redvers Road.     | 1.40            | XI.    | Lligwy .....                  | 3.04            |
| „     | Ramsgate .....                | 2.39            | „      | Douglas .....                 | 3.21            |
| „     | Hailsham .....                | 2.94            | XII.   | Stoneykirk, Ardwell House...  | 4.09            |
| „     | Totland Bay, Aston House...   | 3.81            | „      | Dalry, The Old Garroch.....   | 2.59            |
| „     | Stockbridge, Ashley.....      | 2.46            | „      | Beattock, Kinnelhead .....    | 2.50            |
| „     | Grayshott .....               | 3.88            | „      | Langholm, Drove Road .....    | 2.63            |
| „     | Caversham, Rectory Road ...   | 1.65            | XIII.  | Meggat Water, Cramilt Lodge   | 2.08            |
| III.  | Harrow Weald, Hill House...   | 1.61            | „      | North Berwick Reservoir.....  | 2.17            |
| „     | Pitsford, Sedgebrook.....     | 1.33            | „      | Edinburgh, Royal Observaty.   | 2.58            |
| „     | Woburn, Milton Bryant.....    | 1.57            | XIV.   | Maybole, Knockdon Farm ...    | 1.61            |
| „     | Chatteris, The Priory.....    | 1.51            | XV.    | Ballachulish House .....      | 2.80            |
| IV.   | Colchester, Hill Ho., Lexden  | 1.07            | „      | Campbeltown, Witchburn ..     | 4.12            |
| „     | Newport, Belmont House ...    | ...             | „      | Holy Loch, Ardnadam.....      | 2.54            |
| „     | Ipswich, Rookwood, Copdock    | 1.18            | „      | Islay, Eallabus .....         | 2.66            |
| „     | Blakeney .....                | .87             | „      | Tiree, Cornaigmore .....      | 2.69            |
| „     | Swaffham .....                | 1.12            | XVI.   | Dollar Academy .....          | 4.91            |
| V.    | Bishops Cannings .....        | 3.11            | „      | Balquhider, Stronvar.....     | 3.98            |
| „     | Winterbourne Steepleton.....  | ...             | „      | Glenlyon, Meggernie Castle..  | 2.59            |
| „     | Ashburton, Druid House.....   | 4.87            | „      | Blair Atholl .....            | 1.99            |
| „     | Cullompton .....              | 1.94            | „      | Coupar Angus .....            | 3.18            |
| „     | Lynmouth, Rock House ...      | 1.59            | „      | Montrose, Sunnyside Asylum.   | 3.13            |
| „     | Okehampton, Oaklands.....     | 1.90            | XVII.  | Alford, Lynturk Manse .....   | 3.41            |
| „     | Hartland Abbey.....           | 2.38            | „      | Fyvie Castle .....            | 2.96            |
| „     | Probus, Lamellyn.....         | 3.13            | „      | Keith Station ..              | 1.92            |
| „     | North Cadbury Rectory.....    | 3.16            | XVIII. | Alvey Manse .....             | 6.10            |
| VI.   | Clifton, Pembroke Road.....   | 3.74            | „      | Loch Quoich, Loan .....       | 2.20            |
| „     | Ross, The Graig .....         | 3.05            | „      | Drumadrochit .....            | 4.17            |
| „     | Shifnal, Hatton Grange.....   | 1.44            | „      | N. Uist, Lochmaddy .....      | 3.35            |
| „     | Droitwich.....                | 1.99            | „      | Glencarron Lodge .....        | 2.95            |
| „     | Blockley, Upton Wold.....     | 3.18            | XIX.   | Invershin .....               | 2.36            |
| VII.  | Market Overton.....           | 2.63            | „      | Melvich .....                 | 4.93            |
| „     | Market Rasen .....            | 1.15            | „      | Loch Stack, Ardchullin .....  | 6.54            |
| „     | Bawtry, Hesley Hall .....     | 3.92            | XX.    | Schibbereen Rectory .....     | 6.97            |
| „     | Derby, Midland Railway.....   | 1.48            | „      | Dunmanway, The Rectory ..     | 5.65            |
| „     | Buxton .....                  | 1.68            | „      | Glanmire, Lota Lodge, No. 1   | 6.33            |
| VIII. | Nantwich, Dorfold Hall .....  | 1.61            | „      | Mitchelstown Castle.....      | 5.02            |
| „     | Chatburn, Middlewood .....    | 1.90            | „      | Darrynane Abbey.....          | 3.41            |
| „     | Cartmel, Flookburgh .....     | 2.62            | „      | Clonmel, Bruce Villa .....    | 5.02            |
| IX.   | Langsett Moor, Up. Midhope    | 2.61            | „      | Newmarket-on-Fergus.Fenloe    | ...             |
| „     | Scarborough, Scalby .....     | .96             | XXI.   | Laragh, Glendalough .....     | 2.99            |
| „     | Ingleby Greenhow .....        | 1.46            | „      | Ballycumber, Moorock Lodge    | 5.54            |
| „     | Mickleton .....               | 3.10            | „      | Balbriggan, Ardgillan .....   | 5.05            |
| X.    | Bellingham, High Green Manor  | 1.86            | XXII.  | Woodlawn .....                | 3.86            |
| „     | Ilderton, Lilburn Cottage ... | 2.04            | „      | Westport, St. Helens ...      | 4.72            |
| „     | Keswick, The Bank.....        | 2.42            | „      | Dugort, Slievemore Hotel ...  | 4.44            |
| XI.   | Llanfrechfa Grange .....      | 4.34            | „      | Mohill Rectory ..             | 4.09            |
| „     | Treherbert, Tyn-y-waun .....  | 3.63            | XXIII. | Enniskillen, Portora.....     | 4.02            |
| „     | Carmarthen, The Friary .....  | 5.85            | „      | Dartrey [Cootehill] .....     | 5.24            |
| „     | Castle Malgwyn [Llechryd]...  | 6.31            | „      | Warrenpoint, Manor House ..   | 4.45            |
| „     | Crickhowell, Tal-y-maes.....  | 4.00            | „      | Banbridge, Milltown .....     | 3.90            |
| „     | New Radnor, Ednol .....       | 2.98            | „      | Belfast, Cave Hill Road ..... | 3.61            |
| „     | Birmingham WW., Tynmynydd     | 3.57            | „      | Glenarm Castle.....           | 3.39            |
| „     | Lake Vyrnwy .....             | 2.61            | „      | Londonderry, Creggan Res...   | 4.34            |
| „     | Llangyhanfal, Plâs Draw.....  | 1.89            | „      | Dunfanaghy, Horn Head ...     | 4.07            |
| „     | Dolgelly, Bryntirion.....     | 4.91            | „      | Killybegs .....               | ...             |
| „     | Bettws-y-Coed, Tyn-y-bryn...  | 3.16            |        |                               |                 |

## METEOROLOGICAL NOTES ON SEPTEMBER, 1913.

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.**—Cloudy or dull generally with occasional sunny days. Fine, bright and dry weather in the last week with a marked rise in temp. Mean temp.  $58^{\circ}9$  or  $1^{\circ}2$  above the average. Duration of sunshine 111.3\* hours, and of R 44.8 hours. Evaporation 1.07 in. Shade max.  $78^{\circ}2$  on 27th; min.  $43^{\circ}0$  on 16th. F 0, f 0.

**TENTERDEN.**—Showery except in the last week which was the finest since May. Duration of sunshine 152.0† hours. A tower was struck during a sharp TS on 16th. Shade max.  $73^{\circ}5$  on 26th; min.  $44^{\circ}0$  on 17th. F 0, f 0.

**TOTLAND BAY.**—Night temps. were higher than in any preceding September since 1891. Duration of sunshine 152.4\* hours. Shade max.  $69^{\circ}8$  on 27th; min.  $45^{\circ}9$  on 17th. F 0, f 0.

**MILTON BRYANT.**—A lovely month. Wind mostly E. and N.E., and just sufficient E. to make the soil workable and set crops growing.

**IPSWICH, COPDOCK.**—A dismal opening gave place to a bright spell of pleasant weather from 10th to 19th and the month closed in brilliant style. Equable temp. throughout. Mean temp.  $58^{\circ}0$ . Shade max.  $71^{\circ}7$  on 26th; min.  $40^{\circ}3$  on 16th. F 0, f 0.

**POLAPIT TAMAR.**—Shade max.  $75^{\circ}3$  on 27th; min.  $41^{\circ}4$  on 11th and 22nd. F 0, f 0.

**NORTH CADBURY.**—The largest R in September since 1899, but a genial pleasant month. Dry hot weather during the last 8 days. The nights of the first 8 and last 8 days were especially warm. Shade max.  $79^{\circ}0$  on 27th; min.  $42^{\circ}0$  on 17th. F 0, f 0.

**HODSOCK PRIORY.**—A warm and quiet month. A series of TSS on 17th. The last week was very warm. Shade max.  $78^{\circ}7$  on 27th; min.  $34^{\circ}7$  on 15th. F 0, f 3.

**SOUTHPORT.**—Duration of sunshine 123.0\* hours, and of R 53.7 hours. Mean temp.  $57^{\circ}3$  or  $1^{\circ}9$  above the average. Evaporation 1.52 in. Shade max.  $73^{\circ}0$  on 27th; min.  $39^{\circ}0$  on 8th. F 0, f 1.

**NEWCASTLE-ON-TYNE.**—On 16th 2.65 in. of R fell in an hour and a half.

**HAVERFORDWEST.**—Duration of sunshine 127.9\* hours. Shade max.  $69^{\circ}9$  on 27th; min.  $42^{\circ}4$  on 19th. F 0, f 0.

**LLANDUDNO.**—Shade max.  $74^{\circ}0$  on 24th; min.  $43^{\circ}0$  on 16th.

**CARGEN.**—Fine harvest weather in the first 10 days, but the remainder of the month was unsettled. Mean temp.  $55^{\circ}1$ . Shade max.  $72^{\circ}8$  on 28th; min.  $37^{\circ}0$  on 17th.

**EDINBURGH.**—Duration of sunshine 80.8\* hours. Shade max.  $71^{\circ}3$  on 24th; min.  $42^{\circ}6$  on 17th. F 0, f 2.

**COUPAR ANGUS.**—The fine summer came to an end on 7th in the middle of the harvest, and the weather has been bad ever since. Shade max.  $67^{\circ}0$  on several days; min.  $34^{\circ}0$  on 2nd.

**LOCH STACK.**—Duration of sunshine 112.8\* hours.

**WATERFORD.**—Shade max.  $74^{\circ}5$  on 11th; min.  $39^{\circ}0$  on 18th.

**DUBLIN.**—Fine and dry to 8th. Heavy R on 13th, 19th and 24th, and fogs on 23rd and 27th. Mean temp.  $56^{\circ}3$ . Shade max.  $70^{\circ}0$  on 11th; min.  $41^{\circ}5$  on 18th. F 0, f 0.

**WARRENPOINT.**—A wet month, but four-fifths of the total fall fell on 3 days, the 13th, 19th and 22nd. On the 19th R fell continuously for 21 hours and measured 2.01 in. Shade max.  $68^{\circ}0$  on 11th; min.  $40^{\circ}0$  on 16th. F 0, f 0.

**OMAGH.**—The fine spell of August continued into the first 10 days of September, but the remainder of the month had broken weather with some fine spells but excessive moisture.

\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, April, 1913.

| STATIONS.<br><br><i>(Those in italics are<br/>South of the Equator.)</i> | Absolute. |        |          |        | Average. |      |               |             | Absolute.       |                   | Total Rain     |       | Aver. |
|--------------------------------------------------------------------------|-----------|--------|----------|--------|----------|------|---------------|-------------|-----------------|-------------------|----------------|-------|-------|
|                                                                          | Maximum.  |        | Minimum. |        | Max.     | Min. | Dew<br>Point. | Humidity.   | Max. in<br>Sun. | Min. on<br>Grass. | Depth.         | Days. |       |
|                                                                          | Temp.     | Date.  | Temp.    | Date.  |          |      |               |             |                 |                   |                |       |       |
|                                                                          |           |        |          |        |          |      |               |             |                 |                   |                |       |       |
| London, Camden Square                                                    | 68°5      | 29     | 26°0     | 13     | 56°6     | 40°3 | 40°4          | 0-100<br>77 | 109°4           | 23°2              | inches<br>2·72 | 21    | 7·2   |
| Malta ... ..                                                             | 75·9      | 27     | 49·9     | 17     | 65·4     | 55·9 | ...           | 81          | 137·5           | ..                | ·73            | 4     | 4·6   |
| Lagos ... ..                                                             | 92·0      | 4      | 72·0     | 5, 7   | 88·7     | 76·7 | 75·4          | 77          | 161·4           | 70·0              | 2·95           | 8     | 6·2   |
| Cape Town ... ..                                                         | 88·1      | 13     | 43·2     | 4, 6   | 71·3     | 51·8 | 54·1          | 79          | ...             | ...               | 2·37           | 8     | 4·7   |
| Natal, Durban ... ..                                                     | 81·0      | 1      | 62·0     | sev.   | 73·6     | 66·1 | 66·5          | 84          | ...             | ...               | 2·26           | 4     | 3·0   |
| Johannesburg ... ..                                                      | 74·9      | 23     | 43·2     | 19     | 68·9     | 51·5 | 49·6          | 76          | 141·4           | 42·0              | 2·23           | 13    | 4·4   |
| Mauritius ... ..                                                         | 84·8      | 22     | 62·8     | 28     | 81·0     | 69·1 | 66·6          | 77          | 155·0           | 55·4              | 4·66           | 20    | 6·3   |
| Bloemfontein .. ...                                                      | 80·6      | 3      | 38·8     | 7      | 72·6     | 49·3 | 48·3          | 72          | ...             | ...               | 2·66           | 8     | 3·1   |
| Calcutta... ..                                                           | 106·6     | 24     | 71·1     | 5      | 97·4     | 77·8 | 74·6          | 71          | ...             | 68·5              | 1·51           | 2     | 1·6   |
| Bombay... ..                                                             | 91·0      | 29     | 71·3     | 1      | 88·9     | 76·8 | 74·2          | 76          | 141·2           | 64·7              | ...            | ...   | 2·4   |
| Madras ... ..                                                            | 99·1      | 7      | 73·5     | 12     | 94·2     | 78·9 | 75·1          | 75          | 145·4           | 71·0              | ·02            | 1     | 2·1   |
| Colombo, Ceylon ... ..                                                   | 89·6      | 5      | 73·1     | 10     | 88·0     | 74·9 | 75·6          | 83          | 159·4           | 70·0              | 12·19          | 21    | 6·4   |
| Hongkong ... ..                                                          | 83·7      | 27     | 58·9     | 10     | 75·8     | 67·7 | 66·7          | 85          | ...             | ...               | 2·18           | 5     | 8·0   |
| Sydney ... ..                                                            | 83·3      | 13     | 52·3     | 28     | 71·1     | 59·4 | 56·9          | 78          | 128·1           | 41·9              | 9·19           | 22    | 5·3   |
| Melbourne ... ..                                                         | 83·5      | 20     | 45·1     | 25, 30 | 69·7     | 52·3 | 50·8          | 69          | 134·5           | 38·9              | 1·35           | 10    | 5·2   |
| Adelaide ... ..                                                          | 91·3      | 9      | 47·3     | 18     | 76·4     | 56·5 | 50·8          | 56          | 149·3           | 38·4              | ·77            | 5     | 4·6   |
| Perth ... ..                                                             | ...       | ...    | ...      | ...    | ...      | ...  | ...           | ...         | ...             | ...               | ...            | ...   | ...   |
| Coolgardie ... ..                                                        | 95·0      | 4      | 43·0     | 25     | 77·2     | 55·4 | 51·6          | 59          | 168·0           | 37·6              | 2·83           | 10    | 4·4   |
| Hobart, Tasmania ... ..                                                  | 78·1      | 10     | 41·7     | 30     | 64·5     | 49·1 | 46·2          | 69          | 136·2           | 32·6              | 2·15           | 8     | 6·2   |
| Wellington ... ..                                                        | 68·2      | 29     | 38·8     | 21     | 60·2     | 49·0 | 46·3          | 73          | 130·6           | 27·0              | 2·96           | 11    | 6·5   |
| Auckland ... ..                                                          | 71·0      | 2, 3   | 41·5     | 21     | 65·2     | 51·0 | 51·9          | 79          | 97·0            | 40·0              | 1·48           | 9     | 4·4   |
| Jamaica, Kingston .. ...                                                 | 86·9      | 1      | 66·4     | 23     | 84·9     | 69·5 | 69·6          | 84          | ...             | ...               | 2·57           | 15    | 4·7   |
| Grenada ... ..                                                           | 88·0      | 13     | 70·0     | 13     | 84·2     | 72·8 | ...           | 74          | 140·0           | ...               | 1·07           | 13    | 3·3   |
| Toronto ... ..                                                           | 76·7      | 25     | 27·7     | 20     | 55·2     | 37·3 | 32·0          | 65          | ...             | 23·3              | 3·50           | 12    | 4·7   |
| Fredericton ... ..                                                       | 83·0      | 25, 26 | 15·0     | 8      | 52·7     | 31·9 | ...           | 71          | ...             | ...               | 2·17           | 10    | 6·2   |
| St. John, N.B. ... ..                                                    | 61·4      | 28     | 19·3     | 8      | 46·6     | 33·7 | 33·0          | 76          | ...             | ...               | 2·89           | 15    | 6·5   |
| Edmonton, Alberta ... ..                                                 | 78·0      | 12     | 20·8     | 29     | 56·2     | 32·3 | ...           | 49          | 128·8           | 16·4              | ·85            | 7     | 4·0   |
| Victoria, B.C. ... ..                                                    | 67·2      | 17     | 30·7     | 28     | 56·5     | 41·4 | 40·0          | 75          | ...             | ...               | ·62            | 10    | 6·9   |

MALTA.—Mean temp. of air 60°·2. Average daily sunshine 9·2 hours.

Johannesburg.—Bright sunshine 233·1 hours.

Mauritius.—Mean temp. of air 0°·1 below, and R ·08 in. above, averages. Mean hourly velocity of wind 11·5 miles or 1·0 miles below average.

COLOMBO.—Mean temp. of air 81°·5 or 1°·2 below, of dew point 1°·1 above, and R 3·87 in. above, averages. Max. velocity of wind 41 miles per hour for about ten minutes on the 10th. TS on 15 days.

HONGKONG.—Mean temp. of air 71°·2. Mean hourly velocity of wind 12·7 miles. Bright sunshine 141·7 hours.

Sydney.—Temp. of air 0°·7 above, and R 3·87 in. above, averages.

Melbourne.—Mean temp. of air 1°·5 above, and R ·97 in. below, averages.

Adelaide.—Mean temp. of air 2°·5 above, and R 1·11 in. below, averages.

Coolgardie.—Temp. of air 0°·9 above, and R 2·19 in. above, averages.

Hobart.—Mean temp. of air 1°·7 above average.

Wellington.—Mean temp. of air 2°·2 below, and R 1·06 in. below, averages. Bright sunshine 148·5 hours.

Auckland.—Unusually dry. Rainfall less than half the average of previous 40 years.

# Symons's Meteorological Magazine.

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## METEOROLOGY AT THE BRITISH ASSOCIATION.

### Section A.

By E. GOLD, M.A.

IN an account of the proceedings at the Birmingham meeting it is natural to comment on the absence of all the heads of the three great Meteorological Organisations of the country from one of the largest and most successful gatherings of natural philosophers which recent years have witnessed.

Mr. J. I. Craig, whose new duties in Egypt did not permit him to remain in England for the meeting, contributed a very important paper entitled "A Temperature See-Saw between England and Egypt." The history of the investigation is an interesting one. Sir Edward Fry wrote a letter to *Nature* in 1911 asking if the abnormal warmth of that year in Europe had been experienced in other parts of the globe. Mr. Craig replied that in Egypt the summer had been much cooler than usual but with characteristic thoroughness he began to investigate the relation between temperature in the two countries in previous years. He found, from an examination of the values for 34 years, that the correlation co-efficients indicated that the temperature swung in opposite directions in the two countries; when one was up, the other was down and *vice-versa*. Examining different seasons separately, he found that the correlation was most marked in the first and last quarters of the year when the values of  $r$  were  $-.72$  and  $-.43$  respectively for Cairo and South-west England. He then calculated the values of  $r$  between Egypt and other European stations and by using the results obtained he drew *lines of equal correlation* for January, April, July and October. The method is of fundamental importance in the treatment of the problem of "centres of action," and we may look forward to the time when each country will have its own set of monthly or seasonal iso-correlational lines, and will issue seasonal forecasts based upon them and upon the up-to-date information for the places which they indicate as "centres of action." Mr. Craig's charts show that for Egypt a "centre of action" is probably situated to the N.W. of South-west England in winter and to the West of France and Spain in summer.



It is interesting to note that Mr. R. C. Mossman was being led to the method of iso-correlational lines in his studies recently published in *Symons's Meteorological Magazine*, and that Prof. Exner of Innsbruck has recently adapted this method in an important paper published in the *Sitzungsberichten* of the Vienna Academy.

Mr. E. Gold and Mr. F. J. W. Whipple showed some curves of frequency of maximum and minimum temperature for Kew and Valencia Observatories for different months, and in the case of maximum temperature at Kew, for the year also. The monthly curves were steeper on the side of higher temperature in winter and of lower temperature in summer, indicating the opposite effect of the ocean in the two seasons. The curves for maximum temperature in April at the two places were remarkably different; for Kew the curve was wide and flat, indicating a variable day temperature with no value that could fairly be called "normal"; for Valencia the curve was narrow and steep with a well defined maximum at the "normal value." The differences between the curves show real differences of climate, and it is essential for the proper representation of the climate of a place that its frequency curves should be specified, possibly by reference to a set of typical curves. In the annual curves a double maximum occurs, *i.e.*, there are two values of the temperature which occur more frequently during the year than any others; these two temperatures are situated on either side of the mean value; in the case of maximum temperature at Kew, one value is  $4^{\circ}$  or  $5^{\circ}$  F. above the mean, and the other  $4^{\circ}$  or  $5^{\circ}$  F. below it. As regards temperature the year may be divided into three seasons, winter, summer and equinoctial, each season including four months. The slightly cool days of the equinoctial season reinforce the warm days of the winter season and produce the lower maximum; the slightly warm days of the equinoctial season reinforce the cool days of the summer season and produce the upper maximum. If the temperature of a particular day of the year were always the same in different years, the annual variation remaining as at present, there would be a relatively large number of *cold* days and of *hot* days; the effect of the variability is to bring the positions of the maxima closer together and to give large numbers of *cool* days and of *warm* days. The mathematical investigation of Mr. Whipple, which has brought out these points, shows that the maxima approach one another and diminish in intensity, as the daily variability increases, until the curve has a flat top; after which only one maximum occurs which becomes sharper as further increase takes place in the daily variability.

In one of the smaller lecture rooms of Mason College was placed an exhibit of meteorological charts and diagrams, selected for the information, which they gave, of the meteorological conditions between England and Australia at the time of year of the visit of the Association to Australia next year. The advice to be deduced from the exhibit appears to be that if the journey is to be made by separate routes (of which the Suez Canal route is one), going and returning,

"go by the other route and come back by the Suez route." The exhibit was found to be of interest to teachers and others, as well as to those who are travelling to Australia next year.

The report of the Joint Committee for the Investigation of the Upper Air was presented at the meeting. The ascents at Mungret College, Limerick, have been continued with funds provided by the Royal Meteorological Society, and with the co-operation of the Rev. W. O'Leary, S.J., to whom meteorologists are greatly indebted for providing them with the data for the investigation of the vertical structure of a stationary British cyclone which had its centre near Limerick at the time of the International Ascents last May. The British Association grant of £50, made at Dundee, was allocated to the purchase of equipment for upper air work on the "ice ship" *Scotia*. Mr. G. I. Taylor, who had charge of the work, returned at the end of August and reported that balloon work had not been possible owing to cloud, wind and other unfavourable conditions, but that he had obtained interesting results with kites, especially over fog. On one occasion, while those on board the *Scotia* were experiencing the unpleasantness of a fog at a temperature of 45° F., the instrument (properly ventilated) on the kite above, was recording 75° F., semi-tropical warmth on the cold north Atlantic. The Committee asked for re-appointment with a grant of £25, which has been allocated to them.

## METEOROLOGICAL NEWS AND NOTES.

PROF. CHARLES F. MARVIN, professor of meteorology, has been appointed to succeed Dr. Willis L. Moore as chief of the U.S. Weather Bureau. Prof. Marvin is well known for his contributions to meteorology, and was one of the pioneers in the exploration of the air by kites.

PROF. MOHN, who has been Director of the Norwegian Meteorological Institute for close on half a century, has resigned, and is succeeded by Mr. Akel S. Steen.

THE NORFOLK RAINFALL ORGANIZATION's admirable tables, edited since 1899 by Mr. Arthur W. Preston, which have appeared for nearly 50 years in the *Norfolk Chronicle*, are now appearing in the *Eastern Daily Press*, through the courtesy of Mr. Cozens-Hardy.

THE OBSERVATORY AT UCCLE, by Royal Decree of 31st July, is now divided into two distinct establishments, designated the Royal Observatory of Belgium, and the Royal Meteorological Institute of Belgium, under the Directorship of M. Lecointe and M. Vincent respectively.

MR. W. H. DINES, F.R.S., has been awarded the Symons Gold Medal by the Council of the Royal Meteorological Society in recognition of the important work which he has carried out in connection with meteorological science. The medal will be presented on January 21st, 1914, at the annual meeting of the Society.

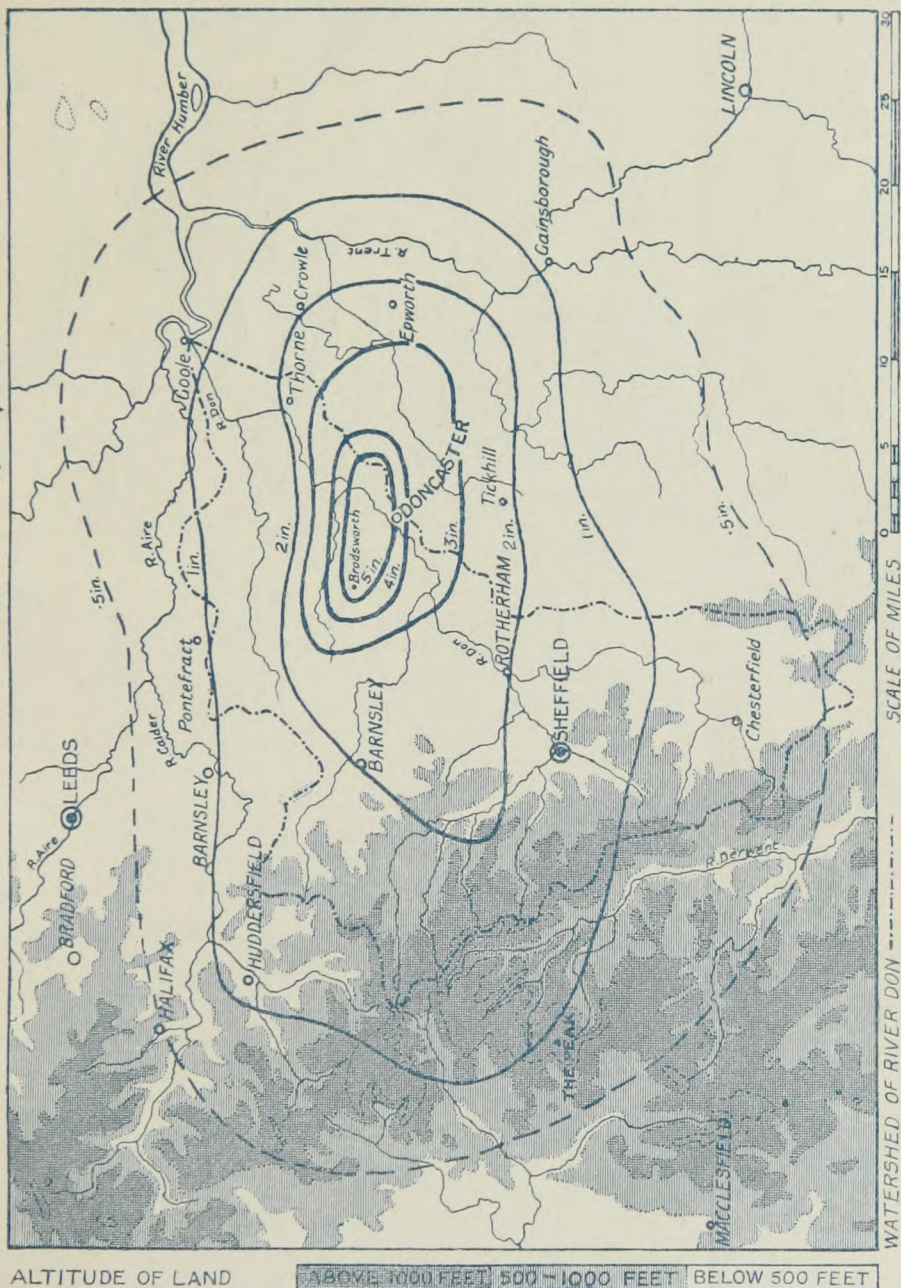
## EXCEPTIONAL RAIN-STORM AT DONCASTER.

IN last month's Magazine a passing reference was made to a heavy rainfall which took place in the vicinity of Doncaster on September 17th. Subsequent investigation having shown that the rainfall was one of the first magnitude, we accordingly give a brief account of it, based on the accompanying preliminary map of the district surrounding Doncaster. Little light is thrown on the cause of the downpour (which lasted some 14 hours, and was restricted to a very small area) by an inspection of the Daily Weather Maps issued by the Meteorological Office. These indicate a very irregular distribution of pressure over north-western Europe, with many ill-defined "lows" and "highs." The most prominent feature of the maps, in so far as they bear on the Doncaster rain-storm, was the presence at 7 a.m. of two low-pressure areas, one over the south of England and Bay of Biscay, the other over Germany, which are shown on the 6 p.m. chart as one large shallow depression. The greatest rainfall seems to have been in Doncaster itself, but the maximum of 6·08 in. at the Pumping Station is undoubtedly too high, as Mr. Salter, who visited Doncaster to inspect the gauges, found the gauge defective, allowing water to enter otherwise than through the funnel. At least three gauges in Doncaster overflowed, and once again we emphasize the necessity for Observers providing themselves with gauges capable of holding at least 6 inches of rain. Some Observers fortunately took the precaution to visit their gauges in the course of the afternoon while the downpour was in progress, otherwise several other records would have been lost. At Avenue Road, Doncaster, Mr. M. H. Stiles noted that rain began to fall at 6 a.m., and at 9 a.m. 41 in. was measured. From 9 a.m. to 4.15 p.m. 3·48 in. fell, and between that hour and 8 p.m. 1·75 in. From 8 p.m. on the 17th to 9 a.m. on the 18th 0·03 in. fell, a total for the whole period of 5·67 in., of which 5·64 in. fell in 14 hours and 5·26 in. during the rainfall day. A thunderstorm prevailed during the whole day of the 17th, from sunrise to sunset. From a large number of returns received, the following cases of more than 3 50 in. during the rainfall day of September 17th are reported:—

|                                 | in.    |
|---------------------------------|--------|
| Doncaster Pumping Station ..... | 6·08 ? |
| Brodsworth Gardens.....         | 5·50   |
| Doncaster (Avenue Road) .....   | 5·26   |
| Wyndthorpe .....                | 5·00   |
| Carr House Hospital.....        | 4·27   |
| Hexthorpe Hall .....            | 3·70   |

At most of the above stations from 40 in. to 76 in. fell before 9 a.m. on the 17th, and as the storm was over by 8 p.m. of that day, practically the whole of the rain fell in 14 hours. There was no recording gauge at work within the area of heavy fall, but at Huddersfield rain began at 10.15 a.m. and concluded at 11 p.m., the hourly values showing nothing exceptional.

# RAINFALL OF SEPTEMBER 17<sup>TH</sup>, 1913





# THAMES VALLEY RAINFALL — OCTOBER, 1913.



ALTITUDE SCALE

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

SCALE OF MILES



The following provisional statement of the area involved in the rain storm will, of course, be slightly modified when the subject is treated in *British Rainfall* from more ample material, but the values given, based on the accompanying map, may be looked upon as close approximations.

|                         | Area,<br>sq. miles. | General Rainfall,<br>inches. | Volume of Rain,<br>sq. miles x inches. |
|-------------------------|---------------------|------------------------------|----------------------------------------|
| More than 5 inches ...  | 21                  | 5·33                         | 112                                    |
| 4—5 inches .....        | 24                  | 4·42                         | 106                                    |
| 3—4 „ .....             | 80                  | 3·48                         | 278                                    |
| 2—3 „ .....             | 254                 | 2·41                         | 613                                    |
| 1—2 „ .....             | 699                 | 1·45                         | 1,014                                  |
| ·50—1 inch .....        | 1,024               | ·74                          | 753                                    |
| Total more than ·50 in. | 2,102               |                              | 2,876                                  |

The general rainfall of the area with more than ·50 in. was 1·37 in., while the general rain over the Don Valley was 1·83 in., and the volume of rainfall which drained into that river was 1,236 square mile-inches, or 17,890 millions of gallons of water. Practically every basement in the town of Doncaster was flooded.

The only Yorkshire rain-storm of which we have any record comparable with that under consideration was the Ilkley Flood of July 12th, 1900 (see *British Rainfall*, 1900, p. 16). On this occasion 5·40 in. was the maximum fall reported, and one Observer who recorded 4·01 in., measured 3·75 in. in one hour and a quarter, or at the rate of 3·00 in. per hour, whereas in the Doncaster storm the average fall per hour was about ·40 in. We have no information, however, as to the maximum intensity, though this does not appear to have been excessive.



## THE WEATHER OF OCTOBER.

DURING the first ten days of the month the weather was of an unsettled type, heavy rains were frequent and temperature was considerably above the normal. During this time a succession of cyclonic disturbances from the south-west moved eastwards, with their centres, as a rule, over the south of England.

The month opened with anti-cyclonic conditions in the north of the British Islands, while the southern part was under the influence of a cyclonic area central in the Bay of Biscay. Temperature was in excess of the average, rising to a maximum of 68° on the 1st at Spurn Head. On the 2nd torrential rains were recorded in Buckinghamshire, Hedsor reporting 1·57 in., of which 1·08 in. fell in an hour; and Newport Pagnell 1·60 in., of which 1·30 in. fell in half an hour; while at Upton Wold, near Blockley, 2·00 in. fell. Rains of much the same character were noted on the 3rd when 2·00 in. fell at Dilham, in Norfolk, during a thunderstorm, in an hour; 1·25 in. at Norwich in half an hour; and 1·80 in. at Leamington between 6.30 and 9 p.m.

On the 4th a heavy rain occurred in the south-west of Ireland; 2·18 in. at Kenmare; and 2·12 in. at Killarney. On the 5th, when a large low pressure area lay over the south of the country, heavy rains were reported in Lincoln, Notts, Shropshire and Denbigh: Boston having as much as 3·14 in.; Horncastle, 2·30 in.; while at Southwell on this and the day following 3·47 in. fell within 24 hours.

On the 10th a large area of high pressure appeared in the north-east, between Faerøe and Norway, which was associated with low temperatures over many parts of Scotland and the north of England, readings of 28° being noted at West Linton, 30° at Fort Augustus and 31° at Durham; while at Holyhead, on the other hand, the minimum was 48°. On the 11th strong south-east winds or gales occurred at many exposed points on our coasts, accompanied by a marked rise of temperature, which became general over the country on the 12th and 13th. Heavy rain fell over the west of Scotland on the 13th, Bendamph reporting 2·35 in.; Ballachulish House, 2·11 in.; and Dunvegan, in Skye, 1·72 in. This mild type of weather continued for some days, temperature on the 16th rising to 68° at Guernsey, and on the 17th, in the north of Scotland, Gordon Castle and Strathpeffer reported 66°.

During the second half of the month the British Isles were largely under the influence of cyclonic disturbances whose centres on many days lay between the north of Scotland and the south of Iceland, but which were occasionally located to the south-east or south-west of Ireland. The cyclonic type was interrupted from the 23rd to 25th by the passage of an anti-cyclone across the country from west to east, during which temperature on the 24th fell at Birr Castle and Cahir to 24°, and to 25° at Kilkenny, West Linton, Cally, and Newton Reigny. Heavy rain fell in the north-west of Scotland on this day, Glencarron reporting 2·69 in., and Loch Stack, 1·86 in.

During the last five days of the month strong southerly winds, reaching gale force at times, were of daily occurrence at exposed parts on our coasts, temperature continuing very high for the season. A remarkable whirlwind of great violence swept down the Taff Valley in Wales on the afternoon of the 27th, which wrecked many buildings and was associated with loss of life. About the same time (4 p.m.) a severe thunderstorm with heavy hail and rain was experienced in the vicinity of Exeter, while at 8 p.m. the immediate neighbourhood of Church Stretton was visited by a whirlwind of great fury accompanied for a least 20 minutes by a thunderstorm of tropical intensity, and a fall of exceptionally heavy rain and hail. The diameter of the wind swept area, which traversed a valley close to Wolstaston Rectory, 3 miles from Church Stretton, was estimated at 200 yards, and much damage was done to some farms in the track of the cyclone.

The general rainfall of the month expressed as a percentage of the average was: England and Wales, 98; Scotland, 72; Ireland, 106; British Isles, 93.



## THE "BRITISH" RAIN GAUGE.

THE attention of the British Rainfall Organization has been for many years directed towards inducing instrument makers to reduce the cost to the public of standard pattern rain gauges whilst at the same time discouraging the sale of badly constructed gauges.

The standard Snowdon rain gauge is now constructed almost exclusively either of copper or of galvanized iron, the funnel being fitted with a ring of turned brass, and the use of zinc or of japanned tin has been abandoned as a general rule. The cost of the instrument depends largely upon the cost of the metal used, and the problem of reducing the price therefore becomes in great measure a problem of the substitution of a cheaper metal for the body of the gauge without sacrificing the accuracy of the instrument. Provided that a rain gauge is used with a correctly graduated measuring jar, its accuracy depends solely upon the proper construction of the funnel and the diameter of the brass ring which determines the area of the receiving surface. The lower part of the gauge, however, has a far less important function to perform, being merely a shell over which the funnel is fitted, and a container for the glass bottle in which the water is collected. This glass bottle stands within a loose inner can which can hold the water in case of overflow or breakage of the bottle. As far as the utility of the rain gauge is concerned, the outer vessel might as well be made of wood, varnished papier-maché, or other cheap substance, and a great saving in cost of material thus effected.

Following this line of reasoning, Messrs. Negretti & Zambra, of Holborn, have recently introduced a gauge in which the funnel, with its brass ring, the inner can and the glass bottle are identical with those of their standard Snowdon gauge, but in which the outer can is made of a cheap combination of lead and iron. This outer can is of serviceable strength and with careful handling will last for many years, and it can be replaced at a very small cost when necessary. Should this outer can become damaged or leaky the efficiency of the gauge is in no way impaired, provided the other parts of the instrument are kept in proper order.

The British Rainfall Organization having arranged to reduce the charge of 2s. 6d. hitherto made for testing the accuracy of a Snowdon rain gauge to 1s. 6d., Messrs. Negretti & Zambra are able to offer the gauge, including measuring jar and certificate of accuracy, at the inclusive price of 10s., a reduction of 33 per cent. on the cost of the cheapest Standard gauge in their price list.

We are happy to call the attention of those Observers, to whom cost is a matter for consideration, to this important cheapening, though it should be borne in mind that the "British" rain gauge does not pretend to compete on equal terms with the ordinary Snowdon gauge constructed throughout of the same material, and that the few extra shillings charged for the Snowdon are always well expended.



## WEATHER FALLACIES.

By A. O. WALKER, F.L.S.

*Concluded.***Effect of Low Temperature on Vegetation.**

Mean minima are useless in relation to this : it is the one or two nights of intense frost that kill tender plants. On the S. and W. coasts of the British Isles, owing partly to the relatively greater amount of humidity in the air and partly to the greater prevalence of wind, the winter minima are generally high compared with inland and east coast stations, and shrubs and plants can be grown which would not survive a moderately severe winter in most inland or east coast localities. But, as regards the comfort of visitors to the S. and W. seaside resorts, the relatively high night temperatures are more than balanced by the greater amount of wind. Every one knows that a temperature of  $40^{\circ}$  with even a moderate breeze is more disagreeable than a calm at  $30^{\circ}$ .

There is no greater fallacy than the belief that a locality with high winter minima will have high summer maxima—the reverse is the case. Moist climates in the temperate zone have temperate winters and summers—dry climates have cold winters and hot summers.

In inland places there are great local differences in temperature, even within a comparatively small distance, owing to variations in the configuration of the land, of which the following table will serve as an example, the distance between Maidstone and Ulcombe being only 7 miles.

*Minimum Temps. on Grass.*

| 1912.           | Maidstone. | Ulcombe. |
|-----------------|------------|----------|
| October 6 ..... | 24         | 34       |
| „ 7 .....       | 26         | 33       |
| „ 8 .....       | 28         | 38       |
| „ 9 .....       | 30         | 39       |
| „ 10 .....      | 32         | 46       |

The explanation of which is that the Maidstone station is nearly at the bottom of the deep Medway valley, while the Ulcombe station is half-way up the S. slope of the Lower Greensand ridge, which is here about 300 feet high.

It is a common belief that temperature falls as the height increases ; this, within such limits as are found in the southern counties, is both true and untrue ! It is generally true as regards day temperature but untrue as to night temperature, which is proved on the one hand by the earlier flowering of plants in spring at the foot of the hill, and on the other by the greater immunity of tender shrubs and plants half-way up it, from injury by frost compared with those at the foot.

This is a fact of considerable economic importance to fruit growers, the orchards in the former position both flowering earlier and being

liable to more severe frost than those higher up. But if they are planted at or near the top of the hill they seem to suffer too much from their greater exposure to cold winds, which appear to be very injurious to the blossoms even when the temperature is considerably above 32°.

### Snow.

It is commonly believed that snow supplies more water to the land than its equivalent in rain. In other words, that the land and springs will receive more from 1 ft. of snow than from its approximate equivalent 1 inch of rain. It is difficult to see how this can be the case at any time, and when fine sunny weather follows the fall of snow, with cold winds, the evaporation from its surface is so great that the amount absorbed by the land is greatly reduced. It is even believed by some that snow has actual fertilizing effect! No doubt in times of severe frost it does protect the roots of plants, but that is all that can be said for it.

### Wind.

It is commonly supposed that the S.W. wind is warm and the E. cold, especially in the spring. But at Ulcombe at 9 a.m. on May 7th, 1913, with wind S.W. 5 and occasional sunshine, the shade temp. was 48°·5, and on the following morning, with the wind E. 5 and sky completely overcast all morning, it was 51°·5. And on February 6th, 1895, at Colwyn Bay a strong S.S.W. wind did probably more damage to tender shrubs than even the severe frosts of that terrible winter, the day's *maximum* being 24°·7!

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## Correspondence.

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

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### MILDNESS OF THE AUTUMN.

It may be of interest to put on record that in the garden here strawberries are now flowering freely, and fruit has set. Fruit has also ripened a second time on the raspberries. In a garden close by a second crop of Victoria plums has ripened; though small they are sweet and of good flavour.

The rainfall for the past month has been 5·47 in.; the average for the past six years being 5·11 in. Last Sunday, the 26th, rain began to fall at 10 o'clock and fell continuously till 7 p.m., when 1·11 in. had fallen. The total next morning was 1·18 in. The gauge is 500 feet above sea level.

J. F. LEIGH CLARE.

*The White Cottage, Heathfield, Sussex, 2nd Nov., 1913.*

### THE METEOR OF SUNDAY, AUGUST 3rd, 1913.

On the evening of Sunday, August 3rd, I crossed from Kingstown to Holyhead on board the City of Dublin Steam Packet Company's Royal Mail S.S. "Leinster." The night was fine, with a brisk N. wind, and streaks of cirrus and cirro-stratus across the sky. When some 15 miles off Holyhead harbour, I was sitting on the leeward side of the steamer. Quite suddenly the sky became brilliantly illuminated with an emerald light, and a splendid meteor of dazzling beauty was seen to glide majestically across the south-western sky, gradually falling towards the south-western horizon. The same resplendent object was seen at the same moment of time (10.55 p.m. Dunsink Observatory—that is "Irish"—mean time) by members of my family resident at Greystones, Co. Wicklow—some 50 miles W. by S. of my position.

This wonderful meteoric fireball apparently began its visible aerial flight over South Wales at a height of 87 miles approximately. At the moment of disappearance it was vertically over Waterford at an estimated height of 18 miles. These figures have been arrived conjointly at by Mr. W. F. Denning, F.R.A.S., of Bristol, and by the Astronomical Correspondent of the *Irish Times* newspaper. The latter observed the meteor from Fethard-on-Sea, Co. Waterford, and gives a graphic description of it in letters addressed to that newspaper under the dates August 4th and 7th. He considers that the meteor was near its "radiant point," its course, therefore, being directed downwards at a very steep angle, nearly vertical. "It would, therefore," he writes, "encounter an atmosphere rapidly increasing in density, and as it was travelling at a speed of about 15 miles per second, or 40 times the pace of a Lee-Metford rifle bullet, it was no wonder that it made a sensational blaze."

JOHN W. MOORE, M.D.

40, Fitzwilliam Sq., Dublin, Sept. 10th, 1913.

### RAINSTORM AT KINGTON, ON 6th OCTOBER, 1913.

1.08 inches of rain fell between 20 minutes to 5 p.m. and 5 minutes past 5, or in half-an-hour.

I was out walking in the afternoon without overcoat or umbrella, and the sky clear with sunshine. At about 15 minutes after 4 o'clock a slight drizzle of rain began and I started for home, and got into the house just after 4.40 p.m., my coat then being well wetted, but it was not wet through. The heavy rain ceased about 5 p.m., and at 5.5 p.m. had practically ceased, and 1.08 in. of rain was measured in the gauge, so that except a few hundredths the whole downpour occupied only about 18 or 20 minutes. .27 in. more fell during the night. There was practically no fall in the barometer till *after* the storm, when it fell about three-tenths of an inch. My daughter noted the times.

G. F. PEARSON.

Kington, Herefordshire, 7th October, 1913.

## THE CLIMATE OF TORQUAY.

I do not see that Sir John Edwards-Moss makes much headway with his figures.

It is hardly permissible to compare a fifty years' average of rainfall at Greenwich with a four winters' average of Torquay, three of them very wet. If application had been made to Mr. March for the averages of 37 years, he would have found the Torquay winter to have 9.96 in., which is less than twice the Greenwich average, 5.24 in. (He represents Torquay to have three times as much.)

While Greenwich has about 24 inches in the year, Torquay has about 33 in., which is far from an extreme amount in Britain.

Your correspondent has always heard July and August spoken of as the wettest months of the year, whereas Torquay has most rain in (1) October, (2) December, Greenwich in (1) October, (2) July.

The affirmed low humidity of Torquay air, Sir John lightly brushes aside as irrelevant. This seems to need explanation.

As to summer temperature, it is true, and perhaps surprising to some, that the shade readings at Cary Green near the harbour very rarely get into the eighties. I am inclined to think there are some spots where it does so less rarely, but I have no figures in proof of this.

Running through all Sir John writes is the fallacy that Roby Hall may be taken to represent Torquay, which in several respects it does not.

ALEX. B. MACDOWALL.

*Torquay, October 22nd, 1913.*

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“FEBRUARY FILLDYKE.”

I THINK there is something to be said in defence of this old saying, which Mr. A. D. Walker, in his paper on “Weather Fallacies,” treats rather scornfully.

It is when springs have been replenished, and ponds refilled, by the rains of late autumn and winter that ditches begin to run. Till then many of them are dry, but afterwards any considerable quantity of rain finds its way into them at once. Consequently an amount of rain which at this time of the year would produce very little visible effect, will in February fill ditches, and rivers too, to overflowing.

There is also the possibility of a heavy snowfall to be considered, for the correct version is, I believe,

“February Filldyke,  
Black or White.”

H. S. TABOR, F.R.Met.Soc.

*Fennes Braintree, Fennes, Oct. 28th, 1913.*

## NOTE ON FROZEN PRECIPITATION.

By L. C. W. BONACINA.

AN Italian writer has recently published a pamphlet dealing with the subject of glazed frost (*gelicidis*), in which he discusses some observations of the Rev. R. P. Dansey in Herefordshire, and of Dr. Hellman in Germany, which confirm his theory that rain falling in a temperature below the freezing point to produce the phenomenon of the "glazed frost," or "silver thaw," is due to the presence of a warm stratum above the cold surface air, and is not in any way an instance of super-cooling. The author observes that there are naturally fewer opportunities of studying this generally rather infrequent phenomenon in Italy than in the northern countries of Europe, and this, perhaps, explains why the author, who appears to have been the first in print to assign its cause to inversions of temperature, should have thought it worth while going into the subject so fully. Having seen the phenomenon so frequently in the south of England I must confess I have never postulated any other cause than that of a warm layer overhead. In England a warm southerly current will often climb over the shoulders, as it were, of a cold surface easterly current, ultimately replacing it, and in such cases the premonitory symptom of a thaw is liquid rain, or ice-rain, falling while the surface temperature is still well below the freezing point. In this manner we are robbed of many an expected snow-storm. The cold surface air, of course, tends to freeze the rain, and so instead of liquid rain we may get ice-rain. And this leads us on to recognize five distinct species of frozen precipitation. These, excluding rime or hoar-frost, which is of the nature of deposition rather than precipitation, are:—*snow*, *hail*, *graupel*, *sleet*, and *ice-rain*. Snow is by far the most important in the economy of nature and is produced by the direct passage of aqueous vapour into the frozen state; it is, indeed, next to rain, the most important of all forms of atmospheric precipitation. Hail (hard or true hail), is apparently a product of thunderstorm activity, and this, together with its peculiar alternate structure, leads one to suppose that the freezing rain drops are carried up and down by currents many times before they finally strike the ground. Graupel (soft hail), are the little white pellets so frequent in moderately cold weather; as it does not occur in severe cold it seems reasonable to ascribe its origin to the passage of aqueous vapour first into liquid drops which freeze before falling. Sleet is the well known mixture of rain drops and snow flakes. Finally we have the form referred to above as being associated with glazed frost and being symptomatic of thaws. It takes the form of plain pellets of colourless ice, and, being the result of the direct freezing of falling rain drops, may be called simply, for want of a more distinctive name, ice-rain. This form fell in London on 11th January, 1913, in the same east wind that brought much snow in the north of England and south of Scotland.

## INTERNATIONAL BALLOON ASCENTS.

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

*December 1st, 1910.*

| Starting Point.   | Country.    | A (H <sub>c</sub> )<br>miles. | B (T <sub>c</sub> )<br>° F. | C<br>miles. | D<br>° F. | E<br>miles. | F        |
|-------------------|-------------|-------------------------------|-----------------------------|-------------|-----------|-------------|----------|
| Pyrton Hill.....  | England ..  | 5·7                           | —69                         | 8·1         | —71       | 38          | N.W.     |
| Brussels .....    | Belgium ..  | 7·4                           | —86                         | 9·5         | —74       | 79          | N. by W. |
| Lindenberg .....  | Germany..   | 7·6                           | —79                         | 9·4         | —72       | 9           | E.S.E.   |
| Strassburg .....  | „ ..        | 6·0                           | —69                         | 7·2         | —73       | 40          | N.N.W.   |
| Vienna .....      | Austria ... | 8·0                           | —87                         | 12·6        | —77       | 9           | E. by S. |
| Pavlovsk .....    | Russia .... | 6·5                           | —88                         | 8·5         | —79       | 44          | N.E.     |
| Nishni Olchedaëff | „ ....      | 6·6                           | —56                         | 9·6         | —67       | 39          | S.S.E.   |

A low pressure area lay over the Channel that by the next day had moved towards Spain, and an extensive anticyclone covered Russia.

*January 5th, 1911.*

|                   |             |     |     |      |     |    |            |
|-------------------|-------------|-----|-----|------|-----|----|------------|
| Manchester.....   | England ..  | 6·5 | —67 | 10·5 | —62 | 80 | S.         |
| Pyrton Hall ....  | „ ..        | 5·2 | —58 | 6·6  | —62 | 27 | S.S.W.     |
| Brussels .....    | Belgium ..  | 5·9 | —70 | 10·7 | —56 | 61 | S.W.       |
| Hamburg .....     | Germany..   | 5·4 | —62 | 9·2  | —62 | 39 | W. by S.   |
| Lindenberg .....  | „ ..        | 6·1 | —62 | 9·7  | —59 | 32 | N.W. by W. |
| Paris .....       | France ...  | 5·5 | —70 | 6·4  | —62 | 31 | S.S.W.     |
| Strassburg .....  | Germany..   | 5·6 | —71 | 6·1  | —65 | 27 | W.S.W.     |
| Munich .....      | „ ..        | 5·6 | —77 | 6·0  | —69 | 14 | N.W.       |
| Vienna .....      | Austria.... | 5·4 | —63 | 8·6  | —63 | 44 | N. by W.   |
| Pavia .....       | Italy ....  | 5·3 | —73 | 17·5 | —58 | 29 | W. by N.   |
| Pavlovsk .....    | Russia .... | 6·3 | —78 | 8·3  | —73 | 10 | N.W. by N. |
| Nishni Olchedaëff | „ ..        | 6·6 | —74 | 7·4  | —66 | 46 | N.E.       |

A Height in miles of commencement of isothermal column.

B Temperature, F°, at bottom of column.

C Greatest height of reliable record in miles.

D Temperature, F°, at greatest height.

E Distance in miles of point where balloon fell.

F Bearing of falling point from starting point.

On January 4th a low pressure area (29·60) lay over the western part of the Mediterranean and a high pressure (30·80) over Finland. To the west of Iceland there was a deep cyclone (28·00), which by the 6th had moved to the east of the island. In the meantime the pressure over parts of Russia had reached 31·00 in. The depression over the Mediterranean remained unaltered, and local depressions formed over southern England and Germany.

The figures for January 5th are very uniform if we consider the distribution of pressure, and the drift was mostly towards the west, in agreement with the surface gradient.

The maximum height of 17·5 miles is correctly transposed from the printed figures, and is equivalent to a pressure of ·45 inches of mercury. It means that the diameter of the balloon at bursting was nearly four times as large as at starting, and twice the usual diameter. Personally I am inclined to doubt the accuracy of the instrument in such cases.

## REVIEWS.

*Anuario Meteorologico de Chile 1911. Publications bajo la direccion del Dr. Walter Knoche No. 3.* (Chilian Meteorological Annual 1911 by Dr. Knoche director.) Santiago de Chile 1912. Size  $15 \times 10\frac{1}{2}$ . Pp. 504 and plates.

*Valores Honorias de los Elementos Meteorologicos en Santiago 1911. Publicaciones bajo la direccion del Dr. Walter Knoche No. 5.* (Hourly Meteorological Values at Santiago during 1911 by Dr. Knoche director.) Santiago de Chile 1913. Size  $15 \times 10\frac{1}{2}$ . Pp. 68 and plates.

IN 1910 the Provincial and the Maritime Weather Services of Chile were amalgamated with others to form the Central Meteorological and Geophysical Institute under the direction of Dr. Walter Knoche. In the above volumes we have a foretaste of the important results which will accrue from the vastly improved and enlarged system of observations now in course of operation. The work of reorganising the service has been one of great difficulty since it involved a complete change of hours which are now 7 a.m., 2 p.m. and 9 p.m., in conformity with International recommendations. Formerly the hours of observation were 7.26 a.m., 10 a.m., 4 p.m. for the Maritime branch of the service, and 3 p.m. for the Provincial. The instrumental equipment of all the stations has been overhauled and renovated by a system of thorough inspection. The annual for 1911 opens with a description of the 33 stations and of the surrounding orographical and other conditions, then are given *in extenso* the tri-daily observations for each station. We are glad to see that the records of evaporation deduced from the Piche instrument have been suppressed. In pages 389 to 461 are given the mean daily values of pressure, humidity, shade temperature and cloud for each station grouped by months of the year, and a complete summary of the mean monthly and mean annual values follows. As the stations extend through  $35^\circ$  of latitude all varieties of climate are to be found. A notable phenomenon of the year was the occurrence of a severe rainstorm, from June 22nd to 25th, in the arid northern region where rain rarely falls. This storm of wind and rain appears to have commenced in Southern Peru on June 20th and at Arica (lat.  $18\frac{1}{2}^\circ$  S.) on June 22nd, at 1.30 a.m. At Iquique (lat.  $20^\circ$  S.) the rain set in at 10.20 p.m. of the same day and at Antofagasta (lat.  $23\frac{1}{2}^\circ$ ) at 2 a.m. on the 24th. At Iquique the temperature during the night of the 23rd rose to  $86^\circ$ , and at Tacna (lat.  $18^\circ$  S.) the wind was so warm that it burnt the face and made respiration difficult. Soon after, the temperature fell rapidly below freezing point, accompanied by a violent wind that did much damage to buildings. On the day following (the 24th) the storm was repeated, with rain. There is no record of a previous visitation of this nature in Northern Chile. The phenomenon embraced over  $20^\circ$  of latitude, extending from lat.  $10^\circ$  S. in Peru to lat.  $30^\circ$  S. in

Chile. The wind blew off the land, and it is of interest to note that on the night of the 24th the captain of the "Quillota," then 50 miles west of Mejillones (lat.  $20^{\circ}$ ), reported a rain of red sand, which covered the decks.

The amount of rain which fell during this storm is not given for Arica and Iquique but at Antofagasta 1.77 in. fell in six hours, and on July 2nd, 2.16 in. fell in two hours, the year's fall being thus 3.93 in. in eight hours, and this at a station where the mean annual rainfall is only .10 in., and the heaviest daily fall previously experienced .20 in. Evangelists Island, in lat.  $52\frac{1}{2}^{\circ}$ , had the maximum rainfall of 119.25 in. on 281 days, with a maximum daily fall, however, of only 2.26 in. The heaviest daily fall reported for any station, 6.09 in. on May 5th, occurred at Point Carranza, amounting to 19 per cent. of the annual total.

With the exception of the excess noted above in the far north of Chile, and a slight excess in the extreme south, the annual rainfall of the year 1911 was well below the normal, and in Santiago less than half the average fell.

The volume (No. 5) gives for the first time *in extenso* complete hourly values of the principal elements at the capital, Santiago. The daily range is well marked in each case, that of rainfall showing a maximum from 1 a.m. to 4 a.m., and a minimum from 8 a.m. to noon.

Both the above volumes are well supplied with plates giving the principal results in graphic form. Dr. Knoche is in every way to be congratulated on his first annual reports, which deal with so important a part of the globe from the point of view of world-meteorology as Chile.

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Indian Meteorological Memoirs. Vol. 22, Part II. *Monthly and Annual Normals of Number of Rainy Days*, by Gilbert T. Walker, C.S.I., M.A., Sc.D., F.R.S. Calcutta, 1913. Size  $12 \times 9\frac{1}{2}$ . Pp. 200. Price 1 Rupee 8 Annas.

THIS volume contains the averages of the monthly and annual number of rainy days at all stations maintained by the Imperial and Provincial Governments where records of not less than five years are available. A rainy day has been defined as one on which .10 in. or more of rain is recorded. No discussion of the data appears in this volume, but from an inspection of the values for stations possessing records of 20 or more years, the maximum number of rainy days per annum is 159 at Cherrapunji, Assam, and also at the Peermode Residency, one of the Travancore Hill Stations in Madras, and the minimum 6 days at Jhatput in Baluchistan.

At the end of the memoir data are given for 24 stations outside the Indian land area, the extremes varying from 165 days, based on 12 years' observations at Garigtok, Tibet, to 4 days per annum at Aden, where the average is based on data covering 29 years.



## RAINFALL TABLE FOR OCTOBER, 1913.

| 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. | 1913.<br>in. |
| Camden Square.....                   | London.....          | 51 32      | 0 8                   | 111                            | 2·72                          | 3·11         |
| Tenterden.....                       | Kent.....            | 51 4       | *0 41                 | 190                            | 3·48                          | 4·57         |
| Arundel (Patching).....              | Sussex.....          | 50 51      | 0 27                  | 130                            | 4·01                          | 4·48         |
| Fawley (Cadland).....                | Hampshire.....       | 50 50      | 1 22                  | 52                             | 4·07                          | 3·81         |
| Oxford (Magdalen College).....       | Oxfordshire.....     | 51 45      | 1 15                  | 186                            | 2·82                          | 4·36         |
| Wellingborough (Croyland Abbey)..... | Northampton.....     | 52 18      | 0 41                  | 174                            | 2·61                          | 3·50         |
| Shoeburyness.....                    | Essex.....           | 51 31      | *0 48                 | 13                             | 2·31                          | 4·57         |
| Bury St. Edmunds (Westley).....      | Suffolk.....         | 52 15      | *0 40                 | 226                            | 2·72                          | 3·25         |
| Geldeston [Beccles].....             | Norfolk.....         | 52 27      | *1 31                 | 38                             | 2·84                          | 3·36         |
| Polapit Tamar [Launceston].....      | Devon.....           | 50 40      | 4 22                  | 315                            | 4·84                          | 4·72         |
| Rousdon [Lynne Regis].....           | .....                | 50 41      | 3 0                   | 516                            | 3·81                          | 3·61         |
| Stroud (Upfield).....                | Gloucestershire..... | 51 44      | 2 13                  | 226                            | 3·21                          | 3·80         |
| Church Stretton (Wolstaston).....    | Shropshire.....      | 52 35      | 2 48                  | 800                            | 3·77                          | 5·48         |
| Coventry (Kingswood).....            | Warwickshire.....    | 52 24      | 1 30                  | 340                            | 3·20                          | 2·62         |
| Boston.....                          | Lincolnshire.....    | 52 58      | 0 1                   | 11                             | 2·75                          | 5·89         |
| Worksop (Hodsock Priory).....        | Nottinghamshire..... | 53 22      | 1 5                   | 56                             | 2·77                          | 3·58         |
| Macclesfield.....                    | Cheshire.....        | 53 15      | 2 7                   | 501                            | 3·53                          | 2·12         |
| Southport (Hesketh Park).....        | Lancashire.....      | 53 38      | 2 59                  | 38                             | 3·74                          | 2·32         |
| Arncliffe Vicarage.....              | Yorkshire, W.R.....  | 54 8       | 2 6                   | 732                            | 6·48                          | 2·22         |
| Wetherby (Ribston Hall).....         | .....                | 53 59      | 1 24                  | 130                            | 3·18                          | 2·85         |
| Hull (Pearson Park).....             | ..... E.R.....       | 53 45      | 0 20                  | 6                              | 3·19                          | 2·87         |
| Newcastle (Town Moor).....           | Northumberland.....  | 54 59      | 1 38                  | 201                            | 3·20                          | 1·81         |
| Borrowdale (Seathwaite).....         | Cumberland.....      | 54 30      | 3 10                  | 423                            | 12·71                         | 7·46         |
| Cardiff (Ely).....                   | Glamorgan.....       | 51 29      | 3 13                  | 53                             | 4·87                          | 5·24         |
| Haverfordwest.....                   | Pembroke.....        | 51 48      | 4 58                  | 90                             | 5·51                          | 6·57         |
| Aberystwyth (Gogerddan).....         | Cardigan.....        | 52 26      | 4 1                   | 83                             | 5·38                          | 4·88         |
| Llandudno.....                       | Carnarvon.....       | 53 20      | 3 50                  | 72                             | 3·78                          | 2·07         |
| Cargen [Dumtries].....               | Kirkcudbright.....   | 55 2       | 3 37                  | 80                             | 4·45                          | 3·87         |
| Marchmont House.....                 | Berwick.....         | 55 44      | 2 24                  | 498                            | 3·83                          | 2·09         |
| Girvan (Pinmore).....                | Ayr.....             | 55 10      | 4 49                  | 207                            | 5·38                          | 3·16         |
| Glasgow (Queen's Park).....          | Renfrew.....         | 55 53      | 4 18                  | 144                            | 3·36                          | 1·64         |
| Inveraray (Newtown).....             | Argyll.....          | 56 14      | 5 4                   | 17                             | 6·50                          | 5·32         |
| Mull (Quinish).....                  | .....                | 56 34      | 6 13                  | 35                             | 5·87                          | 5·44         |
| Dundee (Eastern Necropolis).....     | Forfar.....          | 56 28      | 2 57                  | 199                            | 2·81                          | 1·53         |
| Braemar.....                         | Aberdeen.....        | 57 0       | 3 24                  | 114                            | 3·88                          | 2·32         |
| Aberdeen (Cranford).....             | .....                | 57 8       | 2 7                   | 120                            | 3·23                          | 1·75         |
| Cawdor.....                          | Nairn.....           | 57 31      | 3 57                  | 250                            | 2·95                          | 1·20         |
| Fort Augustus (S. Benedict's).....   | E. Inverness.....    | 57 9       | 4 41                  | 68                             | 4·14                          | 3·31         |
| Loch Torridon (Bendamply).....       | W. Ross.....         | 57 32      | 5 32                  | 20                             | 8·38                          | 9·60         |
| Dunrobin Castle.....                 | Sutherland.....      | 57 59      | 3 50                  | 14                             | 3·15                          | 1·04         |
| Wick.....                            | Caithness.....       | 58 26      | 3 0                   | 77                             | 3·14                          | 1·94         |
| Killarney (District Asylum).....     | Kerry.....           | 52 4       | 9 31                  | 178                            | 5·59                          | 7·13         |
| Waterford (Brook Lodge).....         | Waterford.....       | 52 15      | 7 7                   | 104                            | 4·00                          | 5·30         |
| Nenagh (Castle Lough).....           | Tipperary.....       | 52 54      | 8 24                  | 120                            | 3·48                          | 3·40         |
| Ennistymon House.....                | Clare.....           | 52 57      | 9 18                  | 37                             | 4·40                          | 5·77         |
| Gorey (Courtown House).....          | Wexford.....         | 52 40      | 6 13                  | 80                             | 3·75                          | 3·43         |
| Abbey Leix (Blandsfort).....         | Queen's County.....  | 52 56      | 7 17                  | 532                            | 3·53                          | 5·77         |
| Dublin (Fitz William Square).....    | Dublin.....          | 53 21      | 6 14                  | 54                             | 2·88                          | 3·76         |
| Mullingar (Belvedere).....           | Westmeath.....       | 53 29      | 7 22                  | 367                            | 3·19                          | 3·50         |
| Crossmolina (Enniscoe).....          | Mayo.....            | 54 4       | 9 16                  | 74                             | 5·27                          | 5·40         |
| Cong (The Glebe).....                | .....                | 53 33      | 9 16                  | 112                            | 4·60                          | 4·08         |
| Collooney (Markree Obsy.).....       | Sligo.....           | 54 11      | 8 27                  | 127                            | 4·21                          | 3·07         |
| Seaforde.....                        | Down.....            | 54 19      | 5 50                  | 180                            | 3·65                          | 3·49         |
| Bushmills (Dundarave).....           | Antrim.....          | 55 12      | 6 30                  | 162                            | 3·60                          | 2·20         |
| Omagh (Edenfel).....                 | Tyrone.....          | 54 36      | 7 18                  | 280                            | 3·76                          | 3·19         |

RAINFALL TABLE FOR OCTOBER, 1913—*continued.*

| RAINFALL OF MONTH ( <i>con.</i> ) |          |                   |             |    | 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.      | 1913. | Diff. from Aver. in. | % of Av. |                        |                 |
|                                   |          | in.               | Date.       |    | in.                   | in.   |                      |          | in.                    |                 |
| + .39                             | 114      | .71               | 26          | 15 | 20.64                 | 19.27 | -1.37                | 93       | 25.11                  | Camden Square   |
| +1.09                             | 131      | .71               | 26          | 18 | 21.80                 | 21.60 | - .20                | 99       | 27.64                  | Tenterden       |
| + .47                             | 112      | .84               | 21          | 18 | 24.03                 | 31.15 | +7.12                | 130      | 30.48                  | Patching        |
| - .26                             | 94       | .65               | 29          | 23 | 25.25                 | 26.41 | +1.16                | 104      | 31.87                  | Cadland         |
| +1.54                             | 155      | 1.35              | 2           | 17 | 20.27                 | 18.76 | -1.51                | 93       | 24.58                  | Oxford          |
| + .89                             | 134      | .74               | 5           | 15 | 20.81                 | 19.61 | -1.20                | 94       | 25.17                  | Croyland Abbey  |
| +2.26                             | 198      | 1.00              | 26          | 19 | 15.48                 | 16.26 | + .78                | 105      | 19.28                  | Shoeburyness    |
| + .53                             | 120      | .60               | 26          | 15 | 20.86                 | 19.70 | -1.16                | 94       | 25.40                  | Westley         |
| + .52                             | 118      | .78               | 5           | 24 | 19.17                 | 19.40 | + .23                | 101      | 23.73                  | Geldeston       |
| - .12                             | 98       | .86               | 7           | 19 | 29.74                 | 33.11 | +3.37                | 111      | 38.27                  | Polapit Tamar   |
| - .20                             | 95       | .75               | 6           | 21 | 26.35                 | 26.07 | - .28                | 99       | 33.54                  | Rousdon         |
| + .59                             | 118      | 1.09              | 4           | 20 | 24.33                 | 25.50 | +1.17                | 105      | 29.81                  | Stroud          |
| +1.71                             | 145      | 1.93              | 5           | 18 | 26.48                 | 31.11 | +4.63                | 118      | 32.41                  | Wolstaston      |
| - .58                             | 82       | .42               | 5           | 15 | 23.71                 | 21.70 | -2.01                | 92       | 28.98                  | Coventry        |
| +3.14                             | 214      | 3.14              | 5           | 21 | 19.42                 | 20.11 | + .69                | 104      | 23.35                  | Boston          |
| + .81                             | 129      | .82               | 6           | 18 | 20.31                 | 19.26 | -1.05                | 95       | 24.46                  | Hodsock Priory  |
| -1.41                             | 60       | .58               | 30          | 18 | 28.38                 | 25.79 | -2.59                | 91       | 34.73                  | Macclesfield    |
| -1.42                             | 62       | .41               | 14          | 18 | 26.44                 | 23.20 | -3.24                | 88       | 32.70                  | Southport       |
| -4.26                             | 34       | .54               | 7           | 13 | 48.62                 | 43.46 | -5.16                | 89       | 61.49                  | Arneliffe       |
| - .33                             | 90       | .65               | 31          | 13 | 22.26                 | 18.38 | -3.88                | 82       | 26.87                  | Ribston Hall    |
| - .32                             | 90       | .53               | 3           | 16 | 21.76                 | 16.76 | -5.00                | 77       | 26.42                  | Hull            |
| -1.39                             | 57       | .59               | 7           | 18 | 22.85                 | 24.37 | +1.52                | 107      | 27.94                  | Newcastle       |
| -5.25                             | 59       | 2.00              | 14          | 18 | 100.75                | 96.51 | -4.24                | 96       | 129.48                 | Seathwaite      |
| + .37                             | 108      | 1.04              | 6           | 21 | 33.50                 | 37.18 | +3.68                | 111      | 42.28                  | Cardiff         |
| +1.06                             | 119      | 1.03              | 19          | 18 | 36.47                 | 45.06 | +8.59                | 124      | 46.81                  | Haverfordwest   |
| - .50                             | 91       | .84               | 14          | 20 | 36.30                 | 46.40 | +10.10               | 128      | 45.46                  | Gogerddan       |
| -1.71                             | 55       | .37               | 7           | 16 | 24.33                 | 25.93 | +1.60                | 107      | 30.36                  | Llandudno       |
| - .58                             | 87       | .76               | 13          | 22 | 34.28                 | 38.19 | +3.91                | 111      | 43.47                  | Cargen          |
| -1.74                             | 55       | .52               | 7           | 15 | 27.72                 | 21.67 | -6.05                | 78       | 33.76                  | Marchmont       |
| -2.22                             | 59       | .92               | 13          | 21 | 39.05                 | 33.44 | -5.61                | 86       | 49.77                  | Girvan          |
| -1.72                             | 49       | .73               | 13          | 20 | 28.39                 | 26.41 | -1.98                | 93       | 35.97                  | Glasgow         |
| -1.18                             | 82       | 1.50              | 13          | 20 | 52.71                 | 51.20 | -1.51                | 97       | 68.67                  | Inveraray       |
| - .43                             | 93       | .96               | 13          | 20 | 43.74                 | 40.70 | -3.04                | 93       | 56.57                  | Quinish         |
| -1.28                             | 54       | .25               | 27          | 18 | 23.35                 | 20.16 | -3.19                | 86       | 28.64                  | Dundee          |
| -1.56                             | 60       | .38               | 19, 29      | 19 | 28.04                 | 26.49 | -1.55                | 94       | 34.93                  | Braemar         |
| -1.48                             | 54       | .54               | 6           | 18 | 26.01                 | 22.07 | -3.94                | 85       | 32.73                  | Aberdeen        |
| -1.75                             | 41       | .50               | 24          | —  | 24.20                 | 18.03 | -6.17                | 75       | 29.33                  | Cawdor          |
| - .83                             | 80       | .89               | 13          | 16 | 34.40                 | 32.37 | -2.03                | 94       | 44.53                  | Fort Augustus   |
| +1.22                             | 115      | 2.35              | 13          | 19 | 65.17                 | 62.22 | -2.95                | 95       | 83.93                  | Bendamp         |
| -2.11                             | 33       | .26               | 27          | 11 | 25.56                 | 18.05 | -7.51                | 71       | 31.90                  | Dunrobin Castle |
| -1.20                             | 62       | .30               | 23          | 19 | 23.82                 | 17.87 | -5.95                | 75       | 29.88                  | Wick            |
| +1.54                             | 128      | 2.12              | 4           | 21 | 42.35                 | 46.76 | +4.41                | 110      | 54.81                  | Killarney       |
| +1.30                             | 132      | .74               | 28          | 19 | 31.45                 | 35.14 | +3.69                | 112      | 39.57                  | Waterford       |
| - .08                             | 98       | .77               | 13          | 16 | 31.21                 | 34.32 | +3.11                | 110      | 39.43                  | Castle Lough    |
| +1.37                             | 131      | 1.04              | 29          | 17 | 36.87                 | 41.43 | +4.56                | 112      | 46.52                  | Ennistymon      |
| - .32                             | 91       | .87               | 19          | 18 | 28.16                 | 28.46 | + .30                | 101      | 34.99                  | Courtown Ho.    |
| +2.24                             | 163      | .98               | 10          | 21 | 29.23                 | 35.27 | +6.04                | 121      | 35.92                  | Abbey Leix      |
| + .88                             | 130      | .96               | 7           | 17 | 22.77                 | 24.74 | +1.97                | 109      | 27.68                  | Dublin          |
| + .31                             | 110      | .87               | 28          | 18 | 29.38                 | 32.05 | +2.67                | 109      | 36.15                  | Mullingar       |
| + .13                             | 102      | .98               | 13          | 22 | 41.01                 | 46.77 | +5.76                | 114      | 52.87                  | Ennisceoe       |
| - .52                             | 89       | .50               | 13, 18      | 20 | 38.48                 | 40.71 | +2.23                | 106      | 48.90                  | Cong            |
| -1.14                             | 73       | .39               | 10, 19      | 16 | 34.35                 | 35.20 | + .85                | 102      | 42.71                  | Markree         |
| - .16                             | 96       | .49               | 28          | 17 | 31.28                 | 32.75 | +1.47                | 105      | 38.91                  | Seaforde        |
| -1.40                             | 61       | .39               | 13          | 17 | 29.92                 | 23.45 | -6.47                | 78       | 37.56                  | Dundarave       |
| - .57                             | 85       | .72               | 27          | 16 | 31.81                 | 32.35 | + .54                | 102      | 39.38                  | Omagh           |

## SUPPLEMENTARY RAINFALL, OCTOBER, 1913.

| Div.  | STATION.                      | Rain<br>inches. | Div.   | STATION.                      | Rain<br>inches. |
|-------|-------------------------------|-----------------|--------|-------------------------------|-----------------|
| II.   | Warlingham, Redvers Road .    | 4·26            | XI.    | Lligwy .....                  | 3·19            |
| „     | Ramsgate .....                | 3·97            | „      | Douglas .....                 | 3·46            |
| „     | Hailsham .....                | 6·62            | XII.   | Stoneykirk, Ardwell House...  | 3·06            |
| „     | Totland Bay, Aston House...   | 4·63            | „      | Dalry, The Old Garroch.....   | 4·35            |
| „     | Stockbridge, Ashley ..        | 5·20            | „      | Beattock, Kinnelhead .....    | 5·27            |
| „     | Grayshott .....               | 5·78            | „      | Langholm, Drove Road .....    | 5·10            |
| „     | Caversham, Rectory Road ...   | 4·42            | XIII.  | Meggat Water, Cramilt Lodge   | 4·60            |
| III.  | Harrow Weald, Hill House...   | 2·93            | „      | North Berwick Reservoir.....  | 1·44            |
| „     | Pitford, Sedgebrook.....      | 3·33            | „      | Edinburgh, Royal Observaty.   | 1·49            |
| „     | Woburn, Milton Bryant.....    | 3·45            | XIV.   | Maybole, Knockdon Farm ...    | 2·10            |
| „     | Chatteris, The Priory.....    | 2·45            | XV.    | Ballachulish House .....      | 7·93            |
| IV.   | Colchester, Hill Ho., Lexden  | 3·19            | „      | Campbeltown, Witchburn ..     | 4·36            |
| „     | Newport, Belmont House ...    | ...             | „      | Holy Loch, Ardnadam.....      | 6·25            |
| „     | Ipswich, Rookwood, Copdock    | 3·33            | „      | Islay, Eallabus .....         | 3·79            |
| „     | Blakeney .....                | 2·57            | „      | Tiree, Cornaigmore .....      | 4·61            |
| „     | Swaffham ..                   | 3·78            | XVI.   | Dollar Academy .....          | 2·31            |
| V.    | Bishops Cannings .....        | 2·45            | „      | Balquhiddy, Stronvar.....     | 6·33            |
| „     | Winterbourne Steepleton.....  | ...             | „      | Glenlyon, Meggernie Castle..  | 6·14            |
| „     | Ashburton, Druid House.....   | 5·95            | „      | Blair Atholl .....            | 2·12            |
| „     | Cullompton ..                 | 5·62            | „      | Coupar Angus .....            | 1·72            |
| „     | Lynmouth, Rock House ..       | 4·33            | „      | Montrose, Sunnyside Asylum.   | 1·61            |
| „     | Okehampton, Oaklands... ..    | 4·80            | XVII.  | Alford, Lynturk Manse .....   | 1·48            |
| „     | Hartland Abbey.....           | 3·97            | „      | Fyvie Castle .....            | 1·02            |
| „     | Probus, Lamellyn.....         | 4·81            | „      | Keith Station ..              | 1·40            |
| „     | North Cadbury Rectory.....    | 3·09            | XVIII. | Alvey Manse .....             | 1·82            |
| VI.   | Clifton, Pembroke Road.....   | 2·84            | „      | Loch Quoich, Loan .....       | 20·10           |
| „     | Ross, The Graig .....         | 3·89            | „      | Drumadrochit .....            | 2·23            |
| „     | Shifnal, Hatton Grange.....   | 3·92            | „      | Skye, Dunvegan .....          | 9·10            |
| „     | Droitwich.....                | 3·74            | „      | N. Uist, Lochmaddy .....      | ...             |
| „     | Blockley, Upton Wold.....     | 4·72            | „      | Glencarron Lodge .....        | 10·07           |
| VII.  | Market Overton.....           | 3·19            | XIX.   | Invershin .....               | 1·27            |
| „     | Market Rasen .....            | 2·43            | „      | Melvich .....                 | 1·67            |
| „     | Bawtry, Hesley Hall .....     | 2·95            | „      | Loch Stack, Ardhullin .....   | 7·65            |
| „     | Derby, Midland Railway.....   | 2·76            | XX.    | Skibbereen Rectory .....      | 7·19            |
| „     | Buxton .....                  | 4·01            | „      | Dunmanway, The Rectory ..     | 7·90            |
| VIII. | Nantwich, Dorfold Hall .....  | 3·23            | „      | Glanmire, Lota Lodge, No. 1   | 6·92            |
| „     | Chatburn, Middlewood .....    | 2·13            | „      | Michelstown Castle .....      | 5·78            |
| „     | Cartmel, Flookburgh .....     | 3·61            | „      | Darrynane Abbey.....          | 7·33            |
| IX.   | Langsett Moor, Up. Midhope    | 4·39            | „      | Clonmel, Bruce Villa .....    | 5·48            |
| „     | Scarborough, Scalby .....     | 3·48            | „      | Newmarket-on-Fergus, Fenloe   | 3·12            |
| „     | Ingleby Greenhow .....        | 3·06            | XXI.   | Laragh, Glendalough .....     | 5·15            |
| „     | Mickleton .....               | 3·10            | „      | Ballycumber, Moorock Lodge    | 2·48            |
| X.    | Bellingham, High Green Manor  | 3·03            | „      | Balbriggan, Ardgillan .....   | 4·03            |
| „     | Ilderton, Lilburn Cottage ... | 1·79            | XXII.  | Woodlawn .....                | 3·88            |
| „     | Keswick, The Bank .....       | 4·48            | „      | Westport, St. Helens ...      | 5·35            |
| XI.   | Llanfrecfa Grange .....       | 6·57            | „      | Dugort, Slievemore Hotel ...  | 6·89            |
| „     | Treherbert, Tyn-y-waun .....  | 8·08            | „      | Mohill Rectory ..             | 4·05            |
| „     | Carmarthen, The Friary .....  | 5·17            | XXIII. | Enniskillen, Portora.....     | 2·42            |
| „     | Castle Malgwyn [Llechryd]...  | 4·84            | „      | Dartrey [Cootehill] .....     | 2·72            |
| „     | Crickhowell, Tal-y-maes ..... | 7·80            | „      | Warrenpoint, Manor House ..   | 3·61            |
| „     | New Radnor, Ednol .....       | 5·25            | „      | Banbridge, Milltown .....     | 2·93            |
| „     | Birmingham WW., Tyrmynydd     | 6·02            | „      | Belfast, Cave Hill Road ..... | 4·44            |
| „     | Lake Vyrnwy .....             | 4·87            | „      | Glenarm Castle.....           | 4·83            |
| „     | Llangyhanfal, Plás Draw.....  | 3·23            | „      | Londonderry, Creggan Res...   | 1·99            |
| „     | Dolgelly, Bryntirion.....     | 5·43            | „      | Dunfanaghy, Horn Head ...     | 2·68            |
| „     | Bettws-y-Coed, Tyn-y-bryn...  | 4·30            | „      | Killybegs .....               | ...             |

## METEOROLOGICAL NOTES ON OCTOBER, 1913.

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.—The conditions were fair and mild throughout, with frequent morning fogs and intermittent showers. Mean temp.  $53^{\circ}\cdot4$ , or  $3^{\circ}\cdot3$  above the average. Duration of sunshine  $77\cdot9^*$  hours, and of R  $52\cdot8$  hours. Evaporation  $\cdot61$  in. Shade max.  $70^{\circ}\cdot3$  on 2nd; min.  $36^{\circ}\cdot7$  on 25th. F 0, f 0.

TENTERDEN.—Rather wet in first week; very wet on 11th, 20th, 21st and 26th. TS in evening of 28th. Duration of sunshine  $127\cdot0^{\dagger}$  hours. Shade max.  $68^{\circ}\cdot0$  on 1st; min.  $38^{\circ}\cdot5$  on 23rd. F 0, f 0.

TOTLAND BAY.—Duration of sunshine  $103\cdot7^*$  hours. Mean temp.  $3^{\circ}\cdot5$  above the average. Shade max.  $64^{\circ}\cdot2$  on 3rd; min.  $40^{\circ}\cdot0$  on 24th. F 0, f 0.

IPSWICH, COPDOCK.—A mild and very still month with three well marked wet periods. Duration of sunshine  $100\cdot7^*$  hours. Mean temp.  $52^{\circ}\cdot4$ . Shade max.  $66^{\circ}\cdot3$  on 2nd; min.  $32^{\circ}\cdot0$  on 24th. F 1, f 4.

COLLUMPTON.—Terrific H storm on 27th. Some hailstones measured  $1\frac{1}{2}$  inch in diameter and weighed an ounce. Shade max.  $67^{\circ}\cdot0$  on 3rd; min.  $30^{\circ}\cdot8$  on 22nd. F 1, f 6.

NORTH CADBURY.—Pleasant, genial, sunny, calm and unusually warm. Only 3 days with maxima below  $60^{\circ}$ . Shade max.  $72^{\circ}\cdot0$  on 3rd; min.  $37^{\circ}\cdot5$  on 24th. F 0, f 2.

CHURCH STRETTON, WOLSTASTON.—A cyclone of great fury at 8 p.m. on 27th did much damage. It was accompanied by extraordinary L and T with heavy R and H, and last about 15 minutes.

HODSOCK PRIORY.—Shade max.  $65^{\circ}\cdot7$  on 1st; min.  $30^{\circ}\cdot1$  on 25th. F 3, f 8.

SOUTHPORT.—Duration of sunshine  $52\cdot4^*$  hours, and of R  $50\cdot0$  hours. Evaporation  $\cdot72$  in. Mean temp.  $51^{\circ}\cdot4$ , or  $2^{\circ}\cdot4$  above the average. Remarkable prevalence of light easterly winds. Shade max.  $65^{\circ}\cdot0$  on 1st; min.  $33^{\circ}\cdot0$  on 23rd. F 0, f 4.

HULL.—Fine autumn weather generally. Duration of sunshine  $74\cdot2^*$  hours. Shade max.  $65^{\circ}\cdot0$  on 2nd and 6th; min.  $30^{\circ}\cdot0$  on 10th. F 1, f 6.

HAVERFORDWEST.—Duration of sunshine  $94\cdot2^*$  hours. Shade max.  $69^{\circ}\cdot9$  on 6th; min.  $32^{\circ}\cdot3$  on 24th.

LLANDUDNO.—Shade max.  $68^{\circ}\cdot0$  on 19th; min.  $38^{\circ}\cdot0$  on 24th.

CARGEN.—Mean temp.  $2^{\circ}\cdot5$  above the average of previous 53 years. Pastures unusually green and a great improvement in the turnip crop. Shade max.  $65^{\circ}\cdot5$  on 19th; min.  $25^{\circ}\cdot0$  on 24th. F 3.

EDINBURGH.—Shade max.  $65^{\circ}\cdot1$  on 19th; min.  $33^{\circ}\cdot9$  on 24th. F 0, f 5.

COUPAR ANGUS.—R  $1\cdot03$  in. below the average. Mean temp.  $48^{\circ}\cdot5$ , or  $3^{\circ}\cdot0$  above the average. Short TS on 29th with much L. Shade max.  $61^{\circ}\cdot0$  on 13th; min.  $28^{\circ}\cdot0$  on 10th.

FORT AUGUSTUS.—Shade max.  $63^{\circ}\cdot4$  on 19th; min.  $29^{\circ}\cdot5$  on 10th. F 3.

LOCH STACK.—Duration of sunshine  $97\cdot3^*$  hours.

DUNMANWAY.—A very unsettled but mild month. TS with heavy R on night of 4th.

DUBLIN.—A generally mild month, with heavy R on several days, notably the 5th, 7th and 27th. A cold spell from 21st to 25th inclusive. Mean temp.  $51^{\circ}\cdot9$ , or  $2^{\circ}\cdot6$  above the average. Shade max.  $64^{\circ}\cdot6$  on 13th; min.  $30^{\circ}\cdot0$  on 24th. F 1, f 2.

MARKREE.—The first 10 days were fine and dry with high temp., afterwards showery with heavy falls at times, and frosts on several nights towards the end. Shade max.  $64^{\circ}\cdot0$  on 12th, 13th and 17th; min.  $27^{\circ}\cdot0$  on 25th. F 4, f 7.

OMAGH.—As most of the rain fell during the nights, the month was apparently fine and mild.

\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, May, 1913.

| STATIONS.<br><br>(Those in <i>italics</i> are<br>South of the Equator.) | Absolute. |       |          |       | Average. |       |               |           | Absolute.       |                   | Total Rain |       | Aver.<br>Cloud. |
|-------------------------------------------------------------------------|-----------|-------|----------|-------|----------|-------|---------------|-----------|-----------------|-------------------|------------|-------|-----------------|
|                                                                         | Maximum.  |       | Minimum. |       | Max.     | Min.  | Dew<br>Point. | Humidity. | Max. in<br>Sun. | Min. on<br>Grass. | Depth.     | Days. |                 |
|                                                                         | Temp.     | Date. | Temp.    | Date. |          |       |               |           |                 |                   |            |       |                 |
|                                                                         |           |       |          |       |          |       |               | 0-100     |                 |                   | inches     |       |                 |
| London, Camden Square                                                   | 84°·4     | 26    | 35°·3    | 7     | 67°·8    | 46°·9 | 47°·3         | 73        | 131·3           | 32°·5             | 1·72       | 11    | 6·5             |
| Malta ... ..                                                            | 82°·4     | 14    | 53·0     | 4     | 71·1     | 59·9  | ...           | 77        | 139·0           | ..                | ·81        | 5     | 4·3             |
| Lagos ... ..                                                            | 90·2      | 2     | 72·0     | 11    | 87·4     | 75·9  | 75·1          | 78        | 151·2           | 70·3              | 7·91       | 14    | 6·3             |
| Cape Town ... ..                                                        | 88·9      | 1     | 40·4     | 24    | 68·5     | 53·2  | 52·0          | 74        | ...             | ...               | 2·45       | 14    | 5·7             |
| Natal, Durban ... ..                                                    | 77·0      | 16    | 53·0     | 30    | 71·8     | 60·3  | 57·8          | 77        | ...             | ...               | ·32        | 3     | 3·0             |
| Johannesburg ... ..                                                     | 72·5      | 9     | 32·4     | 24    | 63·4     | 45·7  | 35·9          | 57        | 129·1           | 28·8              | ·06        | 1     | 1·7             |
| Mauritius ... ..                                                        | ...       | ...   | ...      | ...   | ...      | ...   | ...           | ...       | ...             | ...               | ...        | ...   | ...             |
| Bloemfontein .. ..                                                      | ...       | ...   | ...      | ...   | ...      | ...   | ...           | ...       | ...             | ...               | ...        | ...   | ...             |
| Calcutta... ..                                                          | 104·1     | 2     | 69·4     | 12    | 94·3     | 76·4  | 74·8          | 75        | ...             | 67·7              | 8·59       | 12    | 3·7             |
| Bombay... ..                                                            | 94·5      | 31    | 78·8     | 6     | 92·0     | 81·4  | 76·4          | 72        | 139·4           | 73·4              | ...        | ..    | 3·4             |
| Madras ... ..                                                           | 107·7     | 12    | 71·9     | 14    | 98·3     | 80·5  | 74·2          | 69        | 146·5           | 73·1              | 2·14       | 6     | 2·6             |
| Colombo, Ceylon ... ..                                                  | 88·5      | 20    | 71·8     | 22    | 87·3     | 76·7  | 76·1          | 83        | 157·5           | 67·7              | 7·30       | 24    | 6·6             |
| Hongkong ... ..                                                         | 88·5      | 25    | 67·0     | 18    | 82·5     | 73·8  | 71·4          | 82        | ...             | ...               | 9·30       | 17    | 6·9             |
| Sydney ... ..                                                           | 71·0      | 3     | 43·0     | 8     | 63·2     | 52·2  | 50·0          | 79        | 115·9           | 32·6              | 14·91      | 28    | 6·4             |
| Melbourne ... ..                                                        | 69·9      | 1     | 31·9     | 29    | 58·9     | 46·7  | 45·0          | 77        | 109·9           | 28·5              | 3·11       | 16    | 6·8             |
| Adelaide ... ..                                                         | 67·5      | 23    | 41·2     | 10    | 62·9     | 48·2  | 46·8          | 74        | 131·9           | 31·8              | 1·09       | 11    | 6·6             |
| Perth ... ..                                                            | 83·4      | 6     | 42·0     | 23    | 71·4     | 51·6  | 47·5          | 58        | 137·9           | 31·8              | 1·11       | 5     | 3·4             |
| Coolgardie ... ..                                                       | 75·6      | 21    | 38·0     | 28    | 66·9     | 46·3  | 43·6          | 59        | 141·0           | 31·8              | ·63        | 6     | 3·9             |
| Hobart, Tasmania ... ..                                                 | 62·9      | 12    | 32·5     | 30    | 55·5     | 49·2  | 40·2          | 75        | 112·9           | 28·8              | ·14        | 8     | 6·1             |
| Wellington ... ..                                                       | 61·2      | 26    | 34·0     | 22    | 54·6     | 42·6  | 41·3          | 77        | 112·4           | 27·2              | 11·80      | 22    | 6·3             |
| Auckland ... ..                                                         | 61·5      | 7     | 40·0     | 23    | 58·1     | 46·7  | 46·7          | 81        | 125·0           | 35·0              | 4·37       | 22    | 6·4             |
| Jamaica, Kingston .. ..                                                 | 88·3      | 22    | 65·8     | 6     | 86·1     | 70·4  | 69·3          | 78        | ...             | ...               | 3·05       | 9     | 5·6             |
| Grenada ... ..                                                          | 88·0      | 17    | 72·0     | 22    | 85·0     | 74·3  | ...           | 66        | 140·0           | ...               | 1·18       | 9     | 2·8             |
| Toronto ... ..                                                          | 87·0      | 2     | 30·0     | 10    | 64·0     | 44·0  | 39·0          | 59        | ...             | 27·0              | 1·04       | 9     | 4·1             |
| Fredericton ... ..                                                      | 83·0      | 6     | 27·0     | 17    | 58·0     | 37·0  | ...           | 70        | ...             | ...               | 4·04       | 13    | 6·0             |
| St. John, N.B. ... ..                                                   | 66·0      | 3     | 31·0     | 2     | 52·0     | 40·0  | 39·0          | 75        | ...             | ...               | 3·64       | 13    | 5·9             |
| Edmonton, Alberta ... ..                                                | 79·8      | 26    | 24·0     | 5     | 61·0     | 37·8  | ...           | 52        | 133·4           | 17·2              | ·98        | 8     | 5·3             |
| Victoria, B.C. ... ..                                                   | 75·0      | 31    | 37·0     | ...   | 62·0     | 45·0  | 44·0          | 74        | ...             | ...               | ·80        | 10    | 5·7             |

MALTA.—Mean temp. of air 65°·1. Average daily sunshine 8·6 hours.

Johannesburg.—Bright sunshine 281°0 hours.

COLOMBO.—Mean temp. of air 82°·0, or 0°·6 below, of dew point 0°·4 above, and R 3·30 in. below, averages. Max. velocity of wind 37 miles per hour, for about 8 minutes on 24th. TSS on 9 days.

HONGKONG.—Mean temp. of air 77°·2. Mean hourly velocity of wind 12·5 miles. Bright sunshine 168°1 hours.

Sydney.—Temp. of air 0°·8 below, and R 9·81 in. above, averages.

Melbourne.—Mean temp. of air 1°·3 below, and R °96 in. above, averages.

Adelaide.—Mean temp. of air 2°·2 below, and R 1°65 in. below, averages.

Coolgardie.—Temp. of air 1°·0 below, and R 0°·7 in. below, averages.

Hobart.—Mean temp. of air 1°·0 below, and R 1°77 in. below, averages.

Wellington.—Mean temp. of air 4°·7 below, and R 7°00 in. above, averages. Bright sunshine 147°5 hours.

Auckland.—Cold, stormy and showery month. Rainfall under average of previous 44 years. Mean temp. much below average.

# Symons's Meteorological Magazine.

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## UNUSUAL AUTUMNAL WARMTH

THE mean October temperature at Camden Square, derived from the average of the daily maximum and minimum and 9 a.m. and 9 p.m. dry bulb readings, was  $53^{\circ}4$ , or  $3^{\circ}3$  above the 50 years' average, while for November the mean was  $47^{\circ}8$ , or  $4^{\circ}3$  above the normal. The October mean temperature was relatively unimportant because among recent years the Octobers of 1906, 1908 and 1910 were all warmer than that of 1913. November, on the other hand, was much more remarkable, its mean temperature,  $47^{\circ}8$ , or  $4^{\circ}3$  above the normal, being the highest in the 56 years' record at Camden Square, with the single exception of November, 1881, which was exactly one degree warmer. The mean maximum shade temperature was  $54^{\circ}3$ , or  $5^{\circ}2$  above the normal, and the highest ever recorded in November, the nearest approach being  $54^{\circ}2$  in November, 1881. The lowest maximum temperature was  $47^{\circ}2$ , recorded on the 23rd, and this was also a record high value for November. The high mean temperature was due to persistent warm air rather than to days of extreme temperature, there being only four days in the month when temperature failed to reach  $50^{\circ}$ , yet on no day did it exceed  $60^{\circ}$ .

The mean shade minimum temperature,  $41^{\circ}3$ , was  $3^{\circ}1$  above the average and in no way exceptional, higher values having occurred in seven Novembers during the previous 55 years. The only shade frost of the month occurred on the 23rd, when the minimum on the Glaisher stand fell to  $29^{\circ}8$ .

The mean temperature of October and November,  $50^{\circ}6$ , or  $3^{\circ}8$  above the normal, was the highest observed at Camden Square for these two months in the 56 years' record, the nearest approach to this high mean occurring in 1906, when the mean was  $50^{\circ}4$ .

Tables of mean monthly temperature for London since the year 1763 were prepared some time ago by Dr. Buchan and are published in the *Journal of the Scot. Met. Soc.*, Vol. IX., p. 216. A comparison of the mean monthly values there given for October and November, with the corresponding Camden Square means for the 30 years 1861–1890 shows that the mean temperatures for the two months under consideration differ by  $0^{\circ}2$  in October, while in November the two series are identical, so that to make Buchan's series comparable with the present record it is only necessary to

reduce the October and November temperature means by one-tenth of a degree. Looking back over the values since 1763 it was found that the only higher mean temperatures recorded in the period under review were as follows: 1811, mean temperature of October and November,  $53^{\circ}4$ ; 1783,  $52^{\circ}7$ ; 1777,  $52^{\circ}3$ ; 1772,  $51^{\circ}3$ , and 1765,  $50^{\circ}7$ ; so that the present extreme mildness has not been exceeded in the London district for 102 years, when the mildest on record during the last century and a half was recorded.

Mr. A. Watt, Secretary of the Scottish Meteorological Society, has kindly sent us by request some notes on the temperature in Scotland. He says:—

“On the basis of the Eight Large Towns’ Report to the Registrar-General the difference from the normal of the general mean temperature for last month is  $+3^{\circ}7$ , a greater positive difference has occurred only in 1894 ( $+3^{\circ}9$ ), in 1897 ( $+4^{\circ}1$ ), and 1899 ( $+5^{\circ}8$ ), the Reports going back to 1856. It thus seems safe to say that a conspicuously milder November has occurred in Scotland only in 1897 and 1899.”

The Edinburgh values of mean temperature, which Mr. Watt has also sent, show that November there had a mean temperature  $4^{\circ}6$  in excess of the average of the last century and a half, there being four warmer months of the name since 1764, viz., so recently as 1899, in 1894, 1881, and 1818, of these the first named was the mildest of the series, mean temperature being  $6^{\circ}3$  above the normal.

Taking the combined October and November mean temperatures in Edinburgh, the average comes out  $4^{\circ}0$  above the normal, and although there are only five warmer on record, yet so recently as 1908 the mean temperature of October was  $7^{\circ}2$  above the normal and November  $4^{\circ}0$ , a mean of  $+5^{\circ}6$ ; 1899, 1857, 1818, and 1811, being all milder than the two months under review.

Taking the United Kingdom as a whole the mean temperature of November was  $4^{\circ}2$  above the normal, the excess ranging from  $5^{\circ}9$  in the East of England and  $5^{\circ}2$  in the Midland Counties to  $2^{\circ}9$  in the South of Ireland and  $3^{\circ}1$  in the English Channel. The unusual mildness on the whole was specially marked in the eastern parts of the country.

## ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of this Society for the Session was held on Wednesday evening, the 19th instant, at the Institution of Civil Engineers, Great George Street, Westminster, S.W., Mr. C. J. P. Cave, President, in the chair.

Mr. W. H. Dines, F.R.S., read a paper on “The Daily Temperature Change at Great Heights,” in the course of which he remarked that the only direct information available about the diurnal variation of temperature at altitudes beyond that reached by kites was derived

from two series of hourly registering balloon ascents at Manchester. There were numerous observations from registering balloons, but they were very badly distributed owing to the International Aeronautical Committee having fixed 7 a.m., Greenwich mean time, as the hour for the ascents. The continental ascents were thus practically useless, but an attempt was made to utilize the British observations, which were much better distributed for the object in view. There were some 200 British observations available reaching to about 16 kilometres (10 miles), these being divided into two nearly equal groups, the mean time of the one set being two hours after sunrise, and the other about a quarter of an hour after sunset. It was very important to know whether there was a daily range of temperature in the free air at heights exceeding 2 miles. The observations were, therefore, divided into eight hourly groups, sunrise and the four hours after it; the hour before sunset, and the hour after it. Mr. Dines described various difficulties which had to be overcome in the treatment of the available data. The results showed signs of a minimum at 2 and 3 kms. (1 to 2 miles) at about 2 hours after sunrise. A fairly uniform temperature from sunrise to 4 hours later, at and above 3 kms. (2 miles). A similar uniformity throughout the period 1 hour before to 1 hour after sunset throughout all strata. A temperature excess of about  $1^{\circ}\text{C}$ . ( $1^{\circ}\cdot8\text{ F}$ .) at sunset over sunrise from 2 to 8 kms. (1 to 5 miles) inclusive, with a reverse deficiency of  $3^{\circ}\text{C}$ . ( $5^{\circ}\cdot4\text{ F}$ .) at 11 kms. (7 miles) and above. These were the observed facts, but after a careful analysis of the results the conclusion arrived at was that above 2 kms. (1 mile), and up to the limits of the troposphere, the daily range of temperature does not exceed  $2^{\circ}\text{C}$ . ( $3^{\circ}\cdot6\text{ F}$ .), and that the temperature maximum occurs in the afternoon or evening.

Dr. Shaw thought it probable that the differences in the up trace and the down trace, as shown by the instruments, was due to change of temperature in the interval between the rise and fall of the balloon. The heavier instruments used on the continent had a clock attached which would show whether this was really the explanation.

Dr. Chree feared that Mr. Dines had shown some want of confidence in the continental observations. He did not share Mr. Dines' opinion as to the heating up of the air around the balloon, and thought that the paucity of observations was such that particular kinds of days, and kinds of seasons, could hardly be treated independently. Mr. Gold had found from a study of kite and balloon observations made at Lindenberg that the daily variation of temperature at a height of 2 km. was only  $1^{\circ}\cdot5\text{ C}$ . and at 1 km. it was  $2^{\circ}\text{C}$ . He thought that when above the limits of convection the daily variation in temperature ought not to be more than a degree C. He calculated that if the balloon was stationary and absorbing all solar radiation it could not warm up the air at 40 feet distance for more than  $3^{\circ}\text{C}$ . in a day, and in the experiments carried out it was probable that the temperature of the air around the instruments was not raised by more than one-tenth of a degree.



The President emphasized the desirability of the continental observations being taken in the evening as well as in the morning.

Mr. Bryant and Mr. Hooker also took part in the discussion, and Mr. Dines replied.

Mr. H. Harries gave an account of the results of some experimental observations which he had made on the eddy winds of Gibraltar. The rock rises within an area of less than two square miles to heights ranging from 1,100 to 1,400 feet. With easterly winds which blow directly on to the cliff face it was obvious that the stream lines were deflected upwards so that when a strong wind from the east was blowing an observer at the edge of the cliff was in a calm, while a short distance away from the edge, in a westerly direction, a wind from that quarter was met with. These eddy winds were observed by means of small balloons and pieces of wadding on days of strong winds and also during calms.

Lieut. Gill, who had taken part in the experiments with Mr. Harries, said that from the aviator's standpoint the first question was a choice of starting point and of the probable landing place. It was also necessary in carrying out experiments of this kind to consider whether the aviator would use an aeroplane or a waterplane. He considered a further study of wind eddies in the Bay would be of great advantage to those aviators making experiments with waterplanes.

The President thought the paper a further demonstration of the dangers to aviators of descending and ascending currents. He felt sure that the skilled aviator would realise that there are places which he must avoid in certain winds.

The following new Fellows were elected :—Mr. C. E. P. Brooks, B.Sc., Mr. D. C. Buch, Mr. J. W. P. Chalmers, Mr. T. C. Clarke, Capt. C. C. Dixon, Mr. D. Hogarth, Mr. E. H. Hunt, Mr. P. N. Mukerji, M.A., Mr. A. J. Munro, Mr. W. G. Sherman, Mr. A. Thurston, D.Sc., Mr. C. H. Trusler.

## SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

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

(of the Argentine Meteorological Office).

### Sixth Article.

HILDEBRANDSSON has shown in his third memoir, p. 9, that the temperature variations in winter (January and February) are the same over a wide area extending from the Faerøe to Western Siberia, the six stations discussed ranging in latitude from  $59^{\circ}$  to  $64\frac{1}{2}^{\circ}$  N. In the Argentine Republic and Chile, between the parallels, of  $29^{\circ}$  and  $35^{\circ}$  S., and the meridians of  $58^{\circ}$  and  $69^{\circ}$  W., the winter variations of temperature at four selected stations, where long records are available, are in harmony with each other for the period May to August.

On extending the area of inquiry into Brazil, it was found that the winter temperature at Rio de Janeiro (lat.  $23^{\circ}$  S., long.  $44^{\circ}$  W.) was usually not in agreement with the conditions at more southern stations.

In the following table the departure from the normal of the 36 years, 1876-1911, is given for the five stations under discussion, the actual mean temperature being shown graphically in Fig. 1. For the Argentine data we are indebted to Mr. W. G. Davis, Director of the Argentine Meteorological Office; the values for Rio de Janeiro are from Señor Crul's well-known work, supplemented by data since 1890 sent by Dr. Morize; while the Santiago data are from the official publications of that Observatory. The data are strictly comparable since they refer to hourly values in each instance.

*Mean Temperature, May to August. Departure from Normal, 1876 to 1911.*

|                     | 1876 | 1877 | 1878 | 1879 | 1880 | 1881 | 1882 | 1883 | 1884 |       |
|---------------------|------|------|------|------|------|------|------|------|------|-------|
| Santiago de Chile.. | + .3 | +1.8 | + .7 | + .7 | +1.3 | — .4 | — .2 | —1.1 | —1.3 |       |
| Cordoba .....       | + .3 | — .8 | —1.3 | — .3 | +1.6 | —1.7 | .0   | + .3 | .0   |       |
| Buenos Aires .....  | +2.1 | +1.3 | —1.5 | + .3 | +1.3 | — .4 | — .6 | + .4 | —1.3 |       |
| Goya .....          | +3.5 | +2.3 | — .3 | + .7 | +1.0 | —1.2 | — .8 | —1.0 | — .5 |       |
| Rio de Janeiro..... | + .3 | +2.5 | +2.2 | —1.3 | +3.3 | .0   | —1.1 | — .5 | + .4 |       |
| Santiago de Chile.. | 1885 | 1886 | 1887 | 1888 | 1889 | 1890 | 1891 | 1892 | 1893 |       |
| Cordoba .....       | —1.6 | —1.1 | + .8 | — .1 | —1.3 | —2.0 | +1.3 | —2.3 | —1.9 |       |
| Buenos Aires .....  | —2.5 | — .2 | +3.0 | + .3 | —1.5 | —1.1 | — .4 | — .9 | —1.6 |       |
| Goya .....          | —2.8 | —1.0 | +1.3 | — .2 | — .8 | —1.9 | .0   | —1.3 | —1.6 |       |
|                     | —3.8 | —2.4 | + .8 | —1.2 | —1.7 | —3.0 | — .2 | —3.0 | —2.2 |       |
| Rio de Janeiro ...  | +1.6 | —2.4 | + .2 | — .2 | + .6 | — .6 | — .4 | —1.7 | —1.9 |       |
| Santiago de Chile.. | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 | 1901 | 1902 |       |
| Cordoba .....       | — .4 | + .9 | +3.9 | + .6 | — .5 | +1.1 | +1.3 | +1.0 | .0   |       |
| Buenos Aires .....  | — .4 | +3.1 | +3.8 | —1.2 | — .3 | +3.1 | +1.9 | +2.9 | + .4 |       |
| Goya.....           | —1.5 | +2.2 | +2.4 | — .8 | —1.6 | +2.4 | +2.1 | +2.0 | +1.1 |       |
|                     | —1.1 | +2.0 | +2.8 | —1.3 | — .8 | +3.1 | +3.8 | +2.3 | +1.7 |       |
| Rio de Janeiro..... | —1.5 | — .2 | —1.0 | —1.2 | + .3 | + .5 | — .4 | — .3 | +1.4 |       |
| Santiago ...        | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | Mean. |
| Cordoba ...         | — .8 | +2.3 | +2.1 | — .4 | — .1 | + .3 | — .4 | —1.9 | —1.0 | 48.0  |
| Buenos Aires        | — .3 | +1.0 | — .2 | — .6 | —2.8 | + .1 | —1.2 | — .3 | —1.1 | 52.5  |
| Goya .....          | +1.8 | +1.9 | + .3 | + .7 | —1.7 | — .3 | — .7 | — .5 | —1.5 | 52.1  |
|                     | +1.3 | + .6 | +1.4 | +1.1 | — .3 | — .2 | — .4 | + .9 | —2.2 | 59.2  |
| Rio Janeiro         | + .2 | —1.2 | +1.4 | +2.7 | — .4 | +1.0 | + .1 | + .1 | —1.3 | 69.3  |

Excluding the Brazilian station, it will be seen that in two-thirds of the years discussed the departures from the normal were represented by the same sign at all the stations, although the Andine chain separates Santiago de Chile on the west side of the range from

the Argentine stations on the east side. Taking cases in which the temperature departures at the latter stations were all of the same sign, there were only three seasons, viz., those of 1878, 1891 and 1897 in which Santiago differed as regards sign. During the above winters the weather was warm on the west side and cold on the east side of the Andes.

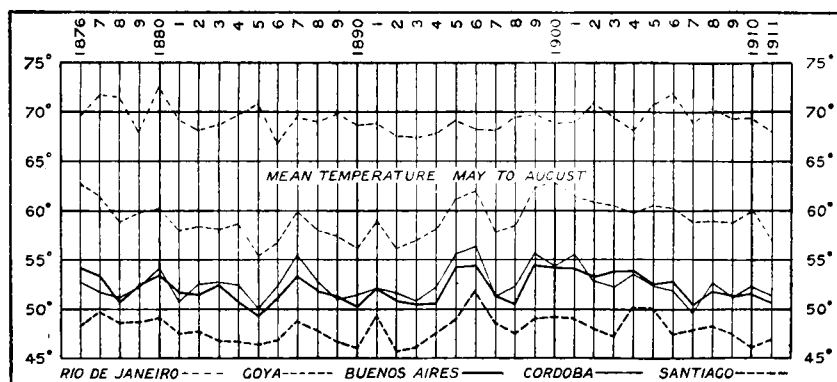


FIG. 1.

The warmest winter was that of 1896 at Santiago, Cordoba and Buenos Aires, and at Goya the temperature was also much above the normal, but at this station the maximum May to August temperature was in 1900.

The coldest winter occurred at Goya and Buenos Aires in 1885, at Cordoba in 1907, and at Santiago in 1892. On the mean of all the stations the warmest season was that of 1896,  $3^{\circ}2$  above the normal, and the coldest 1885,  $2^{\circ}7$  below normal.

The Rio observations show that this part of Brazil is not in general affected by the conditions that govern the temperature variations in the middle latitudes of Argentina and Chile, although in 13 years it is in agreement.

Efforts to correlate the S. American winter temperature variations from 1876 to 1911 with concurrent atmospheric conditions in other regions have, with one partial exception, yielded negative results. The temperature variations at Cape Town during the 21 years 1888 to 1908 agree, however, in the main with the S. American values, as will be seen from the following table showing the departures from the normal for Cape Town and Santiago.

The years of pronounced disagreement were thus 1895, 1898, and 1902, the sign of the departure from the mean in the other 18 years being the same. In the three years 1909-1911 the correlation breaks down completely. The Cape Town mean temperatures are the averages of the maximum and minimum values published monthly in this Magazine.

*Departure from Normal of the Mean Temperature from May to August, from 1888 to 1908.*

|             | 1888              | 1889              | 1890              | 1891              | 1892              | 1893              | 1894              | 1895              | 1896              | 1897              | 1898              |
|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Cape Town   | — <sup>0</sup> ·6 | — <sup>0</sup> ·1 | — <sup>0</sup> ·8 | + <sup>0</sup> ·4 | — <sup>1</sup> ·0 | — <sup>0</sup> ·2 | — <sup>0</sup> ·4 | — <sup>1</sup> ·5 | + <sup>0</sup> ·8 | + <sup>1</sup> ·2 | + <sup>0</sup> ·4 |
| Santiago... | —·3               | —1·5              | —2·2              | +1·1              | —2·5              | —2·1              | —·6               | +·7               | +3·7              | +·4               | —·7               |

|             | 1899 | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | Mean. |
|-------------|------|------|------|------|------|------|------|------|------|------|-------|
| Cape Town   | +·9  | +1·1 | +1·1 | +1·0 | —1·3 | +·2  | ·0   | —1·3 | —·4  | +·3  | 56·0  |
| Santiago... | +·9  | +1·1 | +·8  | —·2  | —1·0 | +2·1 | +1·9 | —·6  | —·3  | +·1  | 48·2  |

### AUCKLAND AND ALICE SPRINGS.

On comparing the mean temperature at Auckland, New Zealand, for the second quarter of the year, with the values at Alice Springs, Australia, for the last quarter, it was found that from 1892 to 1906 the former was an index of the latter. The departures from the normal of the 15 years under review were as follows :—

|                             | 1892              | 1893              | 1894 | 1895              | 1896              | 1897              | 1898              | 1899              |
|-----------------------------|-------------------|-------------------|------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Auckland, April to June...  | + <sup>1</sup> ·1 | + <sup>1</sup> ·6 | ·0   | — <sup>0</sup> ·7 | + <sup>0</sup> ·9 | + <sup>1</sup> ·4 | + <sup>0</sup> ·3 | — <sup>1</sup> ·1 |
| Alice Springs, Oct. to Dec. | +2·1              | +1·5              | +·2  | —1·0              | +3·1              | +2·1              | +1·2              | +·2               |

|                             | 1900 | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | Mean. |
|-----------------------------|------|------|------|------|------|------|------|-------|
| Auckland, April to June...  | +1·9 | +·2  | —·8  | —1·2 | —·7  | —·7  | —1·6 | 57·0  |
| Alice Springs, Oct. to Dec. | +2·3 | +1·8 | —·6  | —3·5 | —1·6 | —1·4 | —3·0 | 78·7  |

At both stations the mean temperature is the average of the max. and min., the values referring to Auckland being extracted from this Magazine or the New Zealand Meteorological Reports ; while for the Alice Springs data we are indebted to Mr. H. A. Hunt, Commonwealth Meteorologist.

### SYDNEY, N.S.W., AND SAN FRANCISCO, CAL.

From 1864 to 1889 a well-marked relation was apparent between the mean temperature at Sydney from May to August and the rainfall at San Francisco during the period October to April following. When the temperature at the one station was below the normal in the May to August period the aggregate rainfall during the period October to April following was deficient at the other place, and *vice versa*.

The mean May to August temperature at Sydney during the above period was 55°·2, and the mean San Francisco rainfall from October to April was 24·0 in. The departures from the normal during the period under review were as follows, the rainfall being given as a percentage above or below the normal. Under the first year, 1864, is given the San Francisco rain data for the seven months ending with April, 1865.

|                        |      |      |      |      |      |      |      |      |          |
|------------------------|------|------|------|------|------|------|------|------|----------|
| Sydney Temp.,          | 1864 | 1865 | 1866 | 1867 | 1868 | 1869 | 1870 | 1871 | 1872     |
| May to August ... deg. | -1   | -1.4 | +1.0 | +1.3 | +2   | +1   | -4   | +3   | -9       |
| San Francisco Rain,    |      |      |      |      |      |      |      |      |          |
| Oct.-April following % | -1   | -12  | +45  | +60  | -11  | -21  | -43  | +27  | -35      |
| Sydney Temp.,          | 1873 | 1874 | 1875 | 1876 | 1877 | 1878 | 1879 | 1880 | 1881     |
| May to August ... deg. | +1.3 | -1.0 | +4   | +2   | +1.1 | -7   | -1.3 | -4   | -4       |
| San Francisco Rain,    |      |      |      |      |      |      |      |      |          |
| Oct.-April following % | 0    | -20  | +29  | -57  | +46  | -11  | +6   | +21  | -35      |
| Sydney Temp.,          | 1882 | 1883 | 1884 | 1885 | 1886 | 1887 | 1888 | 1889 | Mean.    |
| May to August ... deg. | -3   | +2   | +9   | +8   | +4   | -7   | -3   | +8   | 55.2°    |
| San Francisco Rain,    |      |      |      |      |      |      |      |      |          |
| Oct.-April following % | -32  | +21  | -27  | +35  | -22  | -34  | -14  | +86  | 24.0 in. |

In the following diagram (fig. 2), the actual values are shown in graphic form, the Sydney data being derived from a table kindly sent by Mr. H. A. Hunt, while the San Francisco rain has been taken from *Bulletin W* issued by the U.S. Weather Bureau.

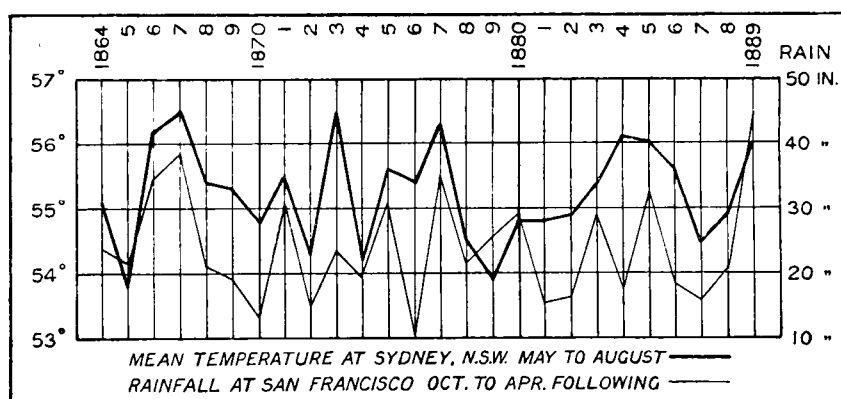


FIG. 2.

### SOUTH ORKNEYS AND KIMBERLEY.

Since the South Orkney observatory was established in 1903 the August and September temperature there has been a direct index of the temperature at Kimberley, South Africa, during the three months following. The South Orkney data are taken, by kind permission of Mr. W. G. Davis, from Vol. 17 of the *Anales* (Part II.) now in course of publication by the Argentine Meteorological Office, while the Kimberley data are from Dr. Sutton's recent paper on "A Preliminary Survey of the Meteorology of Kimberley," published in the *Trans. Roy. Soc. of South Africa*, Vol. 3, p. 226.

The mean temperatures are as follows, being shown graphically in Fig. 3 :—

|                             | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | Mean |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|
| S. Orkneys,<br>Aug. & Sept. | 16°0 | 16°6 | 24°2 | 16°9 | 9°9  | 23°8 | 19°3 | 16°5 | 23°3 | 18°5 |
| Kimberley,<br>Oct. to Dec.  | 74°6 | 74°3 | 76°4 | 73°1 | 72°7 | 75°0 | 74°7 | 73°2 | 77°6 | 74°6 |

Expressed as departures from the normal we have :—

|                | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 |
|----------------|------|------|------|------|------|------|------|------|------|
| S. Orkneys ... | -2°5 | -1°9 | +5°7 | -1°6 | -8°6 | +5°3 | +°8  | -2°0 | +4°8 |
| Kimberley ...  | 0    | -°3  | +1°8 | -1°5 | -1°9 | +°4  | +°1  | -1°4 | +3°0 |

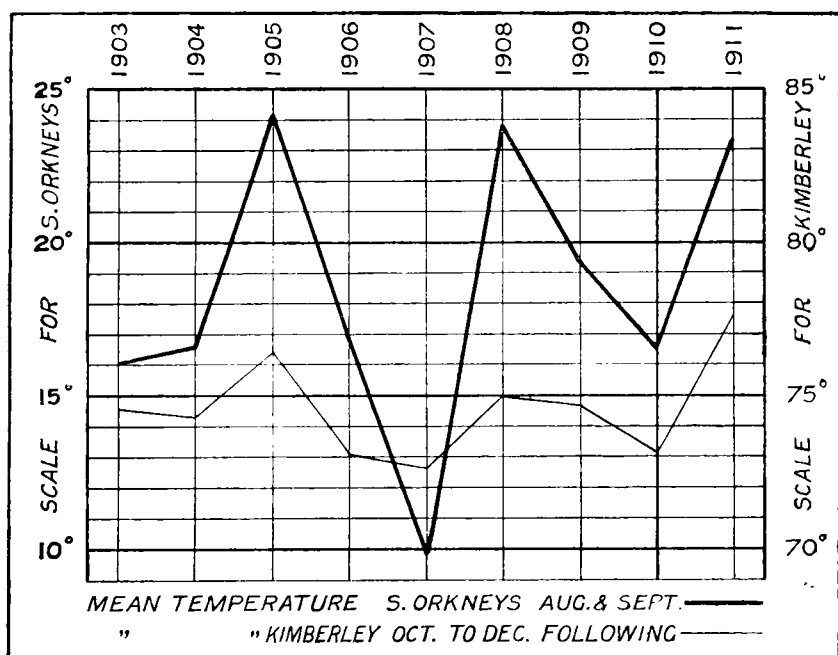


FIG. 3.

The temperature during August and September at the South Orkneys is largely dependent on the ice conditions of the ocean surrounding, and as the ice is moving east-north-east it is feasible to suppose that the temperature prevailing over South Africa is related in some way to the antecedent conditions in the great Southern Ocean. The relation is not a direct one, however, since the temperature at Cape Town for the three months under review is not in harmony with that of Kimberley or the South Orkneys.

BAROMETRIC PRESSURE AT THE SOUTH ORKNEYS  
AND HEIGHT OF THE PARANA.

In the month of December the height of the River Parana at Rosario (lat. 33° S., long. 61° W.), and the mean barometric pressure at Laurie Island, South Orkneys, are intimately related. When the barometric pressure in the sub-Antarctic is high the height of the Parana is also high, and when pressure is low in the far south the Parana is also low. The explanation is that the height of the Parana, as measured at Rosario, really depends on the rainfall over the south of Brazil and adjacent areas, and this is related to the barometric pressure. There is at this time of year a marked tendency for high pressure to the south and south-east of Cape Horn,

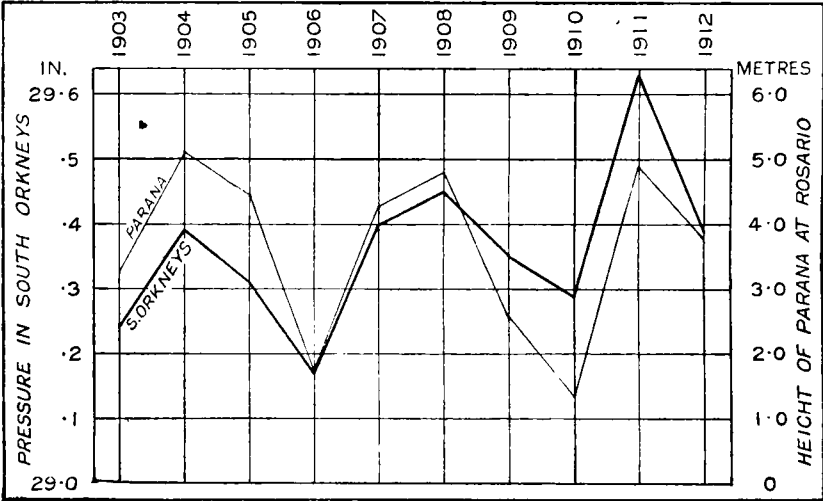


FIG. 4.

and it is not unreasonable to suppose that when the Grahams Land lobe of the Antarctic anti-cyclone is intensified the pressure over the interior of Brazil will be correspondingly diminished, and *vice versa*. The following are the values of barometric pressure in December at the S. Orkneys and the height (in metres) of the Parana at Rosario, the former being derived from the volume already mentioned, and the latter from the records in possession of the Hydrometric Branch of the Argentine Meteorological Office.

| December.                          | 1903  | 1904 | 1905 | 1906 | 1907  | 1908 |
|------------------------------------|-------|------|------|------|-------|------|
| S. Orkneys, Barometer ... (inches) | 29.24 | .39  | .31  | .17  | .40   | .45  |
| Parana at Rosario ..... (metres)   | 3.27  | 5.11 | 4.44 | 1.70 | 4.27  | 4.80 |
|                                    | 1909  | 1910 | 1911 | 1912 | Mean. |      |
| S. Orkneys, Barometer ... (inches) | .35   | .29  | .63  | .39  | 29.36 |      |
| Parana at Rosario ..... (metres)   | 2.57  | 1.32 | 4.92 | 3.79 | 3.62  |      |

The barometric observations are at station level and require a correction of + .07 inch to reduce them to sea-level and gravity. The above data are shown in Fig. 4, and the annexed table gives the departures from the normal.

|                                     | 1903  | 1904  | 1905  | 1906  | 1907  |
|-------------------------------------|-------|-------|-------|-------|-------|
| S. Orkneys, Pressure ..... (inches) | — .12 | + .03 | — .05 | — .19 | + .04 |
| Height of Parana.....(metres)       | — .35 | +1.49 | + .82 | —1.92 | + .65 |
|                                     | 1908  | 1909  | 1910  | 1911  | 1912  |
| S. Orkneys, Pressure ..... (inches) | + .09 | — .01 | — .07 | + .27 | + .03 |
| Height of Parana.....(metres)       | +1.18 | —1.05 | —2.30 | +1.30 | + .17 |

Hence the only year of divergence as regards sign was 1905, and it will be seen that the curves follow each other very closely from one year to another.

(*To be concluded*).

## Correspondence.

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

### FORECASTS.

It has been suggested to me that I ought to say something about the "attack" on the Weather Forecasts of the Meteorological Office by Mr. A. O. Walker, F.L.S., in your issue for October. I am a little doubtful, but if I had to make a reply this is what I should like to say.

First, I can well understand that to anyone who *knows* what the weather is going to be, or to anyone who *does not care*, the forecasts of the Meteorological Office must seem futile; but very few of the 1,000,000,000 people on this planet place themselves in either category. I know of four. The other 999,999,996, so far as they are known to me, are not certain what the weather is going to be, but they do care; and the people who do their best to help them need not be regarded as wasting their time.

Secondly, the weather is not the only subject about which people make forecasts. One often learns much on such a question as Mr. Walker raises by looking around and seeing what is done in other walks of life. In London my experience is that no one can cross a road without making a forecast, which is generally, but not invariably, justified. I never make the perilous voyage across Piccadilly Circus or Trafalgar Square, or, indeed, anywhere else, in a taxi cab without mentally paying a tribute of admiration to the skill in forecasting of the men to whose keeping my life and limbs are, for



the time being, entrusted, and at the end of the journey I generally "signify the same in the usual way." Sometimes it interests me to try to formulate the rules of forecasting which taxi-cab drivers use, but I will not trouble you with the result. One thing is clear that the rules, whatever they are, are not infallible as the records of street casualties show. Mr. Walker's line of argument seems to me to amount to saying that in facing the traffic of the London streets the better way would be to go straight on, pay no attention to it and take the risks. I can only say I do not agree.

Take another case. The whole system of trade is based upon credit which is simply forecasting the willingness and the ability of the other side to keep its bargain. Again the system is not infallible or there would be no bankruptcy court, but the common sense rule of life is neither to trust everybody nor to trust nobody. In this case there are various agencies which supply information (in return for a small fee) and help a business man to make up his mind in a doubtful case.

Such a case is on all fours with that of the Meteorological Office forecasts. We have certain information about the weather which is at the disposal of the public to help anyone who has to come to a decision one way or another in matters with which the weather is concerned. That the inferences are not infallible is not denied, but to quote instances of their failure locally, as conclusive against their utility, is much the same as to quote street accidents as conclusive against caution in street traffic, or occasional bad debts as conclusive against credit.

The only effective way of telling whether forecasts are useful is to try them long enough and regularly enough for them to be as automatic a part of one's practice as the inferences drawn while one pauses on the footway before crossing a road. Knowing what I do about forecasts of various kinds, I am bold enough to say that when that time comes the majority who will "signify their opinion in the usual way" will not be small.

W. N. SHAW.

*Edinburgh, 29th November, 1913.*

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### WEATHER FALLACIES.

MR. A. O. WALKER is very pessimistic in his remarks on this subject, and a good deal of what he says is obviously open to criticism. I only wish now to refer to his objection to the Stevenson screen record of temperature in hot weather, "owing to radiation from the heated wood,"—an objection which, if it were a valid one, would throw doubt not only upon the daily maxima whenever the sun had shone in the course of the day, but also upon the *mean* temperature values deduced from the maxima and minima, in accordance with the common practice. Some years ago Mr. Mawley, a former well-remembered President of the Royal Meteorological Society, to whom

the adoption of the Stevenson screen as the standard screen was largely due, showed me on his lawn at Berkhamsted two such screens alike in every respect, standing side by side, at a distance apart of a few feet. Their exposure to the sun was the same, except that to the south of one of them he had placed a light calico screen, just large enough to intercept the rays which otherwise would have fallen during the middle hours of the day upon the louvred box which contained thermometers. The experiment was intended to test the very point now raised by Mr. Walker, and the answer it gave was, I believe, that the maxima in the two screens were practically identical under all conditions of weather. Possibly, although I cannot recall his doing so, Mr. Mawley may have published an account of his experiment; it was certainly one of great importance and should have been made generally known. But the exposure of thermometers is a subject to which I have myself given some attention, and I have for some years had in use a Stevenson screen in which I keep a very sensitive thermograph giving excellent records. In the screen I have also three control thermometers,—an ordinary mercurial thermometer, a maximum, and a spirit minimum, all tested instruments, which are read every day for comparison with the thermograph trace. The max. is a very sensitive instrument, *unmounted*, and has a slender cylindrical bulb, and both it and the min. are, for want of space, fixed to the back (south) of the screen, the bulbs being three-quarters of an inch away from the louvres; the ordinary thermometer is fixed to the louvres on the west side of the screen; whilst the coil of the thermograph is quite open to the ground which is 4 ft. beneath it. It is extremely rare to find a difference amounting to half a degree between either of the control instruments and the trace, no matter what may have been the character of the weather. This fact leads me to ask whether Mr. Walker's thermometer in the "N. verandah about 20 yards distant," which gave max. readings  $7^{\circ}$  lower than those obtained in the screen, was hung against a wall, or in some position in which its reading was influenced by radiation from cool surroundings, very slow in taking up the temperature of the air? If it was so hung, I submit that in that fact is to be found the explanation of the lower readings mentioned by him; and the difference between the screen and the verandah is explained without the reliability of the screen being affected.

R. H. CURTIS.

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### THE WARM AND THE COLD WINDS.

IN the last number of this Magazine (Nov., page 185), Mr. A. O. Walker objects to the common assumption that the S.W. wind is warm and the E. cold, especially in the spring. He quotes particularly the case of May 7th and 8th, 1913, at Ulcombe, near Maidstone, Kent. On the 7th, 9 a.m., the wind was S.W., force 5, with occasional sunshine, and the temperature  $48^{\circ}\cdot5$ . On the 8th

wind E., force 5, with sky overcast and temperature  $51^{\circ}5$ . Thus the E. wind was warmer than the S.W. wind. Mr. Walker does not try any explanation of the case. And yet the desirable explanation is at hand and the simple principle on which it dwells has been summarily exposed in this Magazine in the years 1903 (page 183), and 1905 (pages 19 and 27), and at length and several times elsewhere since 1886.

On May 7th the Bulletin International of Paris shows a centre of low barometer off Ireland ( $29\cdot27$  in. at Valencia S.<sub>2</sub>,  $29\cdot50$  in. at Scilly, S.S.W.<sub>4</sub>). The wind is S.W. at Greenwich and at Ulcombe; but it blows from W. at Yarmouth and from W.N.W. and N.W. on the French shore of the Channel. All these winds from S.W. to N.W. are divergent or of the nature of anticyclonic winds; the air is in that part of England and on the Channel dispersing and subject consequently to cooling. Since the preceding morning effectively the variation of temperature was  $-3^{\circ}2$  at Greenwich,  $-3^{\circ}1$  at Yarmouth,  $-2^{\circ}0$  at Boulogne,  $-4^{\circ}3$  at Gris Nez, and  $-3^{\circ}2$  at Dunkirk.

The next day, May 8th, at the same hour, the low was south of Ireland ( $29\cdot03$  in. at Valencia E.<sub>2</sub>;  $29\cdot07$  in. at Scilly S.<sub>6</sub>;  $29\cdot28$  in. at Ouessan S.S.W.<sub>9</sub>). The wind on the Channel is reversed, it blows now from S.E. towards the centre of the depression. At Ulcombe the wind E.<sub>5</sub> runs against the S.S.W. at Greenwich, if this S.S.W. is not a deflection at right hand of the former E. direction. Excepting that wind of S.S.W., all other directions in Kent and on the Channel are converging and the concentrating air is subject to warming. The rise of the temperature is naturally the greatest on the Channel,  $+5^{\circ}0$  at Gris Nez, on account of the facing about of the wind.

Related to the centre of low the S.S.W.<sub>4</sub> wind at Greenwich is again rather diverging than converging and there again is noted a lowering ( $-1^{\circ}3$ ) of the temperature in that particular place.

In the year 1898 I have quoted and discussed some fifty remarkable cases of warming or cooling of the different cyclonic and anticyclonic winds, which ought to have created the conviction that the chief dynamical process of the accidental variations of the temperature of the air resides in the convergence and divergence of horizontal currents in the atmosphere, whatever may be the altitude of them.

MARC DECHEVRENS, S.J.

*Jersey, Observatory St. Louis.*

### FROZEN PRECIPITATION.

I AM glad to see Mr. Bonacina's note on Frozen Precipitation. It has never seemed to me that there was any evidence in support of the super-cooled water theory, for, as Mr. Bonacina says, the phenomenon occurs in just those circumstances when warm air above might be expected.

A small local "glazed frost" can be produced by anyone who likes to use a hose or syringe when the temperature is below the freezing point, a fact which I have several times put to a practical use. We have here a workshop with a tiled but unboarded roof and dry snow drives through the openings under the tiles very readily. By using a common garden syringe and a few pails of water the roof can be glazed whenever dry snow is falling, and on three, if not four, occasions we have used this plan; but for the sake of personal comfort during the job we employ lukewarm water, which answers perfectly.

W. H. DINES.

*Pyrtton Hill.*

### THE "BRITISH" RAIN GAUGE.

THE "British" rain gauge, described in your last issue, appears to be an excellent gauge at a moderate price. It would, however, be a great convenience if all instrument makers would state an inclusive price at which a gauge can be delivered at any address in the British Isles. The list price is, as a rule, that at which the gauge is delivered "over the counter," and additional charges for packing and carriage in some cases add fully one-third to the nominal price. It is possible by packing the gauge in loose straw in a rough cardboard case, to ensure safe transit and to bring the total weight within the limit of the parcels post service, and this practice might be generally adopted. One would then be able to let Observers, in any part of the country, know the exact price of a gauge delivered at the door.

ANDREW WATT.

*Scottish Meteorological Society,  
122, George Street, Edinburgh, December 6th, 1913.*

### TEMPERATURE VARIATIONS IN FOG.

THE thermograph reading here on the night of the 24th-25th was rather exceptional. At 9 p.m. the temperature was  $42^{\circ}$ , and  $39^{\circ}$  at midnight. Then followed irregular upward movements to  $42^{\circ}$  at 5.30, followed by a rapid fall to  $38\frac{1}{2}^{\circ}$  at 5.45, and fluctuations down and up again till 6.45. Until then the fog had filled the valley below, but had left us spectators of a glorious volcanic ash (?) sunrise glow from 6 to 6.30. At 6.45 the fog rose rapidly to our level with a clammy chill, and in a quarter of an hour or less the thermograph fell  $4\frac{1}{2}^{\circ}$ , to  $34^{\circ}$ . There was not even a ground frost at this level (360 feet and N.E. slope); presumably the  $34^{\circ}$  indicated the temperature of an exposed thermometer. Sunrise was at 6.41. Max., 2 to 3 p.m.  $62\frac{1}{2}^{\circ}$ .

J. EDMUND CLARK.

*Asgarth, Purley, 26th October, 1913.*

### LONG DRY PERIODS AT TOTLAND BAY.

In Totland Bay there has been an absolute drought of 20 days, beginning on July 20th. We have had a partial drought of 42 days, which began on July 11th, and a long dry period of 93 days, which began on May 30th and gave a total rainfall of 1·93 in.

During my stay of 27 years in Totland I have only experienced five of these long dry periods of less than 2 inches of rain spread over at least thirteen weeks, viz. :—

|              |                                   | Rainfall.<br>in. |
|--------------|-----------------------------------|------------------|
| 95 days..... | 20th February—24th May, 1892..... | 1·88             |
| 109 „ .....  | 17th March—3rd July, 1893 .....   | 1·94             |
| 91 „ .....   | 2nd January—2nd April, 1907 ..... | 1·99             |
| 97 „ .....   | 30th June—4th October, 1911 ..... | 1·90             |
| 93 „ .....   | 30th May—30th August, 1913 .....  | 1·93             |

JOHN DOVER.

*Aston House, Totland Bay, 13th September, 1913.*

### HEAVY RAINS IN CEYLON.

FLOODS occurred at Gampola, Ratnapura, and various places in the Kelani Valley, during October, 1913. Some of the chief rainfalls recorded were as under :—

| STATIONS.         | Height above<br>Sea Level. | Oct. 4th. | Oct. 5th. | Oct. 6th. | Month's<br>Total. |
|-------------------|----------------------------|-----------|-----------|-----------|-------------------|
|                   | ft.                        | in.       | in.       | in.       | in.               |
| Padupola .....    | 1606                       | 12·00     | 21·00     | 22·00     | 74·97             |
| Watawala .....    | 3259                       | 8·05      | 9·14      | 20·65     | 55·28             |
| Strathellie ..... | 2500                       | 11·10     | 20·19     | ·68       | 63·90             |
| Kegalle .....     | 800                        | 1·03      | 14·23     | 10·42     | 42·14             |
| Kandy .....       | 1654                       | ·26       | 5·10      | 6·94      | 26·74             |

At Colombo, floods reached their highest on the 9th under clear sky, *i.e.*, the water came almost entirely from the River Kelani, not from local rain.

The readings from Ratnapura are unfortunately not available owing to the gauge being inaccessible at the crucial time. It is not claimed that the figures at Padupola are more than an approximation.

A. J. BAMFORD.

*Colombo Observatory, Ceylon, 19th November, 1913.*

[The above are inland stations situated approximately in lat. 7° N., long. 80 °E.—ED., *S.M.M.*]

### THE CLIMATE OF TORQUAY.

MR. MACDOWALL reminds me of a story that used to be current at the Foreign Office some thirty or forty years ago. At the request of a friend medically ordered to . . . , the S. of S. asked the British Consul there for a report upon the winter climate. That functionary prefaced his reply by expressing doubts whether he was really





# THAMES VALLEY RAINFALL — NOVEMBER, 1913.



ALTITUDE SCALE

|                |                 |                  |                 |
|----------------|-----------------|------------------|-----------------|
| Below 250 feet | 250 to 500 feet | 500 to 1000 feet | Above 1000 feet |
|----------------|-----------------|------------------|-----------------|

SCALE OF MILES

qualified to give an opinion upon the point, as, though he had spent 37 winters there, he had been solemnly assured by the very best authority that he had experienced 37 *exceptional* seasons! I have spent six winters here, and I have recorded the impressions derived therefrom, and figures as regards the last four confirming those impressions. Mr. MacDowall, whom, for aught I know, birth and life-long residence may qualify for the position of "the very best authority," thinks otherwise. I don't suppose that anything that I could say would convince him, and certainly nothing that he can say will, so long as my rain-gauge approaches its records of recent winters, convert me. But in closing, so far as *I* am concerned, this correspondence, I may assure him that no one hopes more earnestly than myself that the coming winter may go to support his contention rather than my experience, and afford a marked and happy contrast to the deluges and depression of its recent (but of course exceptional) predecessors.

JOHN EDWARDS-MOSS.

*Roby Hall, Torquay, November 27th, 1913.*

### VISIBILITY.

MANY readers of your Magazine have, no doubt, made notes on that distinct clearness of the air which precedes rain. I am not now purposing to make any comments but to ask for commentary remarks from Observers. The matter resolved itself into two questions:—*a.* Is it admitted as a fact that when distant objects appear unusually distinct—objects like a distant shore, as the coast of France seen from this neighbourhood, but not ordinarily visible—or a clear deep blue sky at night, ; is such a spectacle a prognostic of coming rain? *b.* What are the physical conditions which produce such phenomena? Should these enquiries commend themselves to your readers I shall be much interested in their replies.

S. MILLER.

*Deal, 8th October, 1913.*

### THE WEATHER OF NOVEMBER.

THE outstanding features of the weather of November were an almost constant succession of stormy southerly to westerly winds, seldom veering as far as north-west, accompanied by an abnormally high temperature, frequent precipitation which, although above the average in most districts, was seldom heavy, and a marked absence of frost and snow.

Throughout practically the whole month a succession of cyclonic systems moved in the usual north-easterly direction outside our coasts with their centres located over Iceland, and the resultant weather was thus of a generally unsettled character with rough to high seas around our coasts.



Throughout the month there was a marked increase in the intensity of the sub-tropical pressure maxima about the Azores, associated with an unusual deepening of the barometrical minima around Iceland. The barometric gradient between these two regions was thus unusually steep, there being a difference of 1·08 in. of mercury between the latitudes of 65° and 38° N. As the normal difference of pressure on the average of the 47 years, 1865-1911, is ·36 in., the barometric gradient was thus three times steeper than usual, and a quarter of an inch more than the previous maximum of ·83 in. recorded in November, 1890. In the neighbourhood of Stykkisholm, Iceland, in lat. 65° N., the mean barometric pressure (at 32° M.S.L. and lat. 45°), was 29·18 in., being 0·55 in. below the normal and the lowest November pressure since the record commenced in 1845. At Horta, in the Azores, on the other hand, pressure was 30·26 in., or ·17 in. above the normal, so that the anomaly in the pressure gradient was ·72 in., one of the very largest observed in any month between these two "action centres." To the north-east of Iceland pressure increased, the mean at Spitzbergen (from the 7 a.m. values given in the Daily Weather Report of the Meteorological Office), being 29·53 in., while it was 29·20 in. at Isafjord, and 29·16 in. at Reykjavik, on the west coast of Iceland.

During the first half of the month seldom a day passed without gales on some exposed parts of our coasts, with frequent thunderstorms over England. The month opened with high temperatures in the south of our islands, and heavy rain in the west of Scotland, Bendamph reporting 1·82 in. on the 2nd. On the 6th, when a low-pressure area was located over the west of Ireland, temperature fell rapidly in Scotland, with sharp frost in the eastern and central districts, a shade minima of 22° being recorded at Balmoral, with frost over the greater part of Britain. On the 7th a rapid rise of temperature occurred in the north, but in the south a fall had taken place, and by the 8th a general rise was in progress, with maxima as high as 60° in eastern, central and southern England. The general type of pressure distribution was so constant, and the resulting weather so regular that it is not necessary to give a detailed account of the sequence of phenomena from one group of days to the other. At several places in the south-west rain fell every day during the month, among such reporting stations being Darrynane, Waterville, Fenloe, co. Clare, and Northam Vicarage in Devon. Rains exceeding an inch and a half in the 24 hours were uncommon. On the 12th heavy rain fell over Wales, the maximum falls reported being 1·75 in. at Claerwen and 1·71 in. at Dolgelly. Temperature also was unusually high, rising to 62° in the Midlands on the 11th and to 63° at Ventnor on the 12th. On the 17th temperatures as high as 60° were reported as far north as Aberdeen. Heavy rain again fell from the 19th to the 21st. On the 19th many stations in the normally wet area in the west of Scotland reported falls ranging from 1·49 in. at Ballachulish to 2·04 in. at Glencarron and 2·15 in. at

Arisaig, and other stations in Snowdonia and the Lake District also had heavy falls exceeding one-and-a-half inches. On the 20th 2·85 in. fell at Rhiwbryfdir, which had also 1·58 in. on the 19th. Tynywaun reported 3·03 in. on the 20th, but at Seathwaite only 1·50 in. fell. Local heavy rains occurred on the 21st (Monmouth), 23rd (Ireland, N.W.), 26th and 28th (Scotland, W.). Of these the latter was the most important, Loch Stack reporting 3·32 in., and Glencarron 2·27 in. During the last ten days of the month temperature was again very high and varied from 22° at Raunds on the 23rd to 63° at Hawarden on the 27th and 64° at Bettws-y-Coed on the 29th, the month closing with a continuation of unusual warmth.

The general rainfall of the month expressed as a percentage of the average was : England and Wales, 109 ; Scotland, 126 ; Ireland, 116 ; British Isles, 116.

## INTERNATIONAL BALLOON ASCENTS.

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

*February 2nd, 1911.*

| Starting Point.               | Country.    | A (H <sub>c</sub> )<br>miles. | B (T <sub>c</sub> )<br>° F. | C<br>miles. | D<br>° F. | E<br>miles. | F          |
|-------------------------------|-------------|-------------------------------|-----------------------------|-------------|-----------|-------------|------------|
| Manchester.....               | England ..  | 7·3                           | —87                         | 12·8        | —65       | 73          | S.W.       |
| Pyrton Hill.. <i>Feb. 1st</i> | „ ..        | 7·7                           | —94                         | 9·6         | —76       | 40          | S.W.       |
| Pyrton Hill.. <i>Feb. 2nd</i> | „ ..        | 6·5                           | —78                         | 7·7         | —74       | 58          | S.W.       |
| Brussels .....                | Belgium ..  | 6·6                           | —83                         | 13·0        | —65       | 80          | S.S.W.     |
| Hamburg .....                 | Germany..   | 6·2                           | —80                         | 7·6         | —76       | 86          | S.         |
| Lindenberg.....               | „ ..        | 6·6                           | —75                         | 10·3        | —68       | 78          | S.         |
| Paris .....                   | France ..   | 7·3                           | —79                         | 7·8         | —66       | 128         | S.W.       |
| Strassburg .....              | Germany..   | ..                            | ..                          | 5·9         | —65       | 37          | S.W. by S. |
| Pavlovsk .....                | Russia .... | 5·9                           | —72                         | 6·0         | —72       | 48          | S. by W.   |
| Nishni Olchedaëff             | „ ..        | 5·3                           | —56                         | 10·0        | —45       | 46          | S.         |

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 pressure was very high over England, but decreased towards the south-east of Europe. A depression was passing from Iceland on the 2nd to the north of Scandinavia on the 3rd.

The drift to the south and south-west was unusually large over the whole area, and a greater inversion than is usual, 22° at Manchester, occurred at many stations.

## ERRATA.

In July number, p. 110, fourth line from bottom, *for last read first.*

„ August „ pp. 119 to 124, *for Azo read Ajo.*

„ „ „ p. 123, heading to diagram, *for 1876-1904 read 1876-1894.*

„ „ „ p. 124, 17th line from top, *for '37 read '57.*

## RAINFALL TABLE FOR NOVEMBER, 1913.

| 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. | 1913.<br>in. |
| Camden Square.....                   | London.....          | 51 32      | 0 8                  | 111                            | 2'34                           | 2'35         |
| Tenterden.....                       | Kent.....            | 51 4       | *0 41                | 190                            | 3'07                           | 3'25         |
| Arundel (Patching).....              | Sussex.....          | 50 51      | 0 27                 | 130                            | 3'54                           | 4'48         |
| Fawley (Cadland).....                | Hampshire.....       | 50 50      | 1 22                 | 52                             | 3'39                           | 3'75         |
| Oxford (Magdalen College).....       | Oxfordshire.....     | 51 45      | 1 15                 | 186                            | 2'25                           | 2'30         |
| Wellingborough (Croyland Abbey)..... | Northampton.....     | 52 18      | 0 41                 | 174                            | 2'23                           | 1'83         |
| Shoeburyness.....                    | Essex.....           | 51 31      | *0 48                | 13                             | 2'09                           | 2'66         |
| Bury St. Edmunds (Westley).....      | Suffolk.....         | 52 15      | *0 40                | 226                            | 2'40                           | 2'21         |
| Geldeston [Beccles].....             | Norfolk.....         | 52 27      | *1 31                | 38                             | 2'49                           | 1'96         |
| Polapit Tamar [Launceston].....      | Devon.....           | 50 40      | 4 22                 | 315                            | 4'07                           | 5'58         |
| Rousdon [Lynne Regis].....           | ".....               | 50 41      | 3 0                  | 516                            | 3'51                           | 3'30         |
| Stroud (Upfield).....                | Gloucestershire..... | 51 44      | 2 13                 | 226                            | 2'77                           | 2'52         |
| Church Stretton (Wolstaston).....    | Shropshire.....      | 52 35      | 2 48                 | 800                            | 2'94                           | 2'50         |
| Coventry (Kingswood).....            | Warwickshire.....    | 52 24      | 1 30                 | 340                            | 2'61                           | 2'98         |
| Boston.....                          | Lincolnshire.....    | 52 58      | 0 1                  | 11                             | 2'05                           | 2'17         |
| Workshop (Hodsock Priory).....       | Nottinghamshire..... | 53 22      | 1 5                  | 56                             | 1'98                           | 1'74         |
| Macclesfield.....                    | Cheshire.....        | 53 15      | 2 7                  | 501                            | 3'00                           | 3'18         |
| Southport (Hesketh Park).....        | Lancashire.....      | 53 38      | 2 59                 | 38                             | 3'16                           | 3'83         |
| Arncliffe Vicarage.....              | Yorkshire, W.R.....  | 54 8       | 2 6                  | 732                            | 6'12                           | 8'77         |
| Wetherby (Ribston Hall) ..           | ".....               | 53 59      | 1 24                 | 130                            | 2'34                           | 2'07         |
| Hull (Pearson Park).....             | "..... E.R.....      | 53 45      | 0 20                 | 6                              | 2'34                           | 2'17         |
| Newcastle (Town Moor) ..             | Northumberland.....  | 54 59      | 1 38                 | 201                            | 2'63                           | 1'31         |
| Borrowdale (Seathwaite) ..           | Cumberland.....      | 54 30      | 3 10                 | 423                            | 13'59                          | 13'49        |
| Cardiff (Ely).....                   | Glamorgan.....       | 51 29      | 3 13                 | 53                             | 4'08                           | 5'95         |
| Haverfordwest.....                   | Pembroke.....        | 51 48      | 4 58                 | 90                             | 5'16                           | 4'82         |
| Aberystwyth (Gogerddan).....         | Cardigan.....        | 52 26      | 4 1                  | 83                             | 4'50                           | 7'02         |
| Llandudno.....                       | Carnarvon.....       | 53 20      | 3 50                 | 72                             | 3'19                           | 3'63         |
| Cargen [Duntries].....               | Kirkcudbright.....   | 55 2       | 3 37                 | 80                             | 4'35                           | 5'82         |
| Marchmont House.....                 | Berwick.....         | 55 44      | 2 24                 | 498                            | 3'21                           | 1'95         |
| Girvan (Pinnmore).....               | Ayr.....             | 55 10      | 4 49                 | 207                            | 5'24                           | 7'73         |
| Glasgow (Queen's Park) ..            | Renfrew.....         | 55 53      | 4 18                 | 144                            | 3'63                           | 5'09         |
| Inveraray (Newtown).....             | Argyll.....          | 56 14      | 5 4                  | 17                             | 7'39                           | 12'19        |
| Mull (Quinish).....                  | ".....               | 56 34      | 6 13                 | 35                             | 6'24                           | 8'53         |
| Dundee (Eastern Necropolis).....     | Forfar.....          | 56 28      | 2 57                 | 199                            | 2'62                           | 1'79         |
| Braemar.....                         | Aberdeen.....        | 57 0       | 3 24                 | 1114                           | 3'76                           | 2'21         |
| Aberdeen (Cranford).....             | ".....               | 57 8       | 2 7                  | 120                            | 3'29                           | 1'65         |
| Cawdor.....                          | Nairn.....           | 57 31      | 3 57                 | 250                            | 2'60                           | 2'27         |
| Fort Augustus (S. Benedict's).....   | E. Inverness.....    | 57 9       | 4 41                 | 68                             | 4'51                           | 7'32         |
| Loch Torridon (Bendamph).....        | W. Ross.....         | 57 32      | 5 32                 | 20                             | 8'90                           | 14'37        |
| Dunrobin Castle.....                 | Sutherland.....      | 57 59      | 3 56                 | 14                             | 3'25                           | 4'00         |
| Wick.....                            | Caithness.....       | 58 26      | 3 6                  | 77                             | 2'95                           | 3'10         |
| Killarney (District Asylum).....     | Kerry.....           | 52 4       | 9 31                 | 178                            | 5'54                           | 7'48         |
| Waterford (Brook Lodge).....         | Waterford.....       | 52 15      | 7 7                  | 104                            | 3'80                           | 3'62         |
| Nenagh (Castle Lough).....           | Tipperary.....       | 52 54      | 8 24                 | 120                            | 3'88                           | 4'72         |
| Ennistymon House.....                | Clare.....           | 52 57      | 9 18                 | 37                             | 4'62                           | 5'80         |
| Gorey (Courtown House) ..            | Wexford.....         | 52 40      | 6 13                 | 80                             | 3'41                           | 3'88         |
| Abbey Leix (Blandsfort).....         | Queen's County.....  | 52 56      | 7 17                 | 532                            | 3'28                           | 3'68         |
| Dublin (Fitz William Square).....    | Dublin.....          | 53 21      | 6 14                 | 54                             | 2'64                           | 2'24         |
| Mullingar (Belvedere).....           | Westmeath.....       | 53 29      | 7 22                 | 367                            | 3'38                           | 3'07         |
| Crossmolina (Enniscoe).....          | Mayo.....            | 54 4       | 9 16                 | 74                             | 5'75                           | 7'91         |
| Cong (The Glebe).....                | ".....               | 53 33      | 9 16                 | 112                            | 5'00                           | 5'69         |
| Collooney (Markree Obsy.).....       | Sligo.....           | 54 11      | 8 27                 | 127                            | 4'02                           | 5'26         |
| Seaforde.....                        | Down.....            | 54 19      | 5 50                 | 180                            | 3'86                           | 4'41         |
| Bushmills (Dundarave).....           | Antrim.....          | 55 12      | 6 30                 | 162                            | 3'77                           | 4'50         |
| Omagh (Edenfel).....                 | Tyrone.....          | 54 36      | 7 18                 | 280                            | 3'66                           | 3'82         |

## RAINFALL TABLE FOR NOVEMBER, 1913—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. in.  | 1913. in. | Diff. from Aver. in. | % of Av. |                        |                 |
|                          |          | in.               | Date.       |    |                       |           |                      |          | in.                    |                 |
| + '01                    | 100      | '67               | 21          | 17 | 22'98                 | 21'62     | -1'36                | 94       | 25'11                  | Camden Square   |
| + '18                    | 106      | '74               | 12          | 16 | 24'87                 | 24'85     | - '02                | 100      | 27'64                  | Tenterden       |
| + '94                    | 127      | 1'27              | 12          | 18 | 27'57                 | 35'63     | +8'06                | 129      | 30'48                  | Patching        |
| + '36                    | 111      | '62               | 11          | 27 | 28'64                 | 30'16     | +1'52                | 105      | 31'87                  | Cadland         |
| + '05                    | 102      | '52               | 10          | 16 | 22'52                 | 21'06     | -1'46                | 94       | 24'58                  | Oxford          |
| - '40                    | 82       | '59               | 10          | 17 | 23'04                 | 21'44     | -1'60                | 93       | 25'17                  | Croyland Abbey  |
| + '57                    | 127      | '56               | 12          | 14 | 17'57                 | 18'92     | +1'35                | 108      | 19'28                  | Shoeburyness    |
| - '19                    | 92       | '65               | 11          | 15 | 23'26                 | 21'91     | -1'35                | 94       | 25'40                  | Westley         |
| - '53                    | 79       | '62               | 11          | 21 | 21'66                 | 21'36     | - '30                | 99       | 23'73                  | Geldeston       |
| +1'51                    | 137      | 1'09              | 11          | 26 | 33'81                 | 38'69     | +4'88                | 114      | 38'27                  | Polapit Tamar   |
| - '21                    | 94       | '54               | 11          | 19 | 29'86                 | 29'37     | - '49                | 98       | 33'54                  | Rousdon         |
| - '25                    | 91       | '57               | 11          | 18 | 27'10                 | 28'02     | + '92                | 103      | 29'81                  | Stroud          |
| - '44                    | 85       | '36               | 11          | 22 | 29'42                 | 33'61     | +4'19                | 114      | 32'41                  | Wolstaston      |
| + '37                    | 114      | '89               | 12          | 16 | 26'32                 | 24'68     | -1'64                | 94       | 28'98                  | Coventry        |
| + '12                    | 106      | '50               | 10          | 24 | 21'47                 | 22'28     | + '81                | 104      | 23'35                  | Boston          |
| - '24                    | 88       | '31               | 11          | 17 | 22'29                 | 21'00     | -1'29                | 94       | 24'46                  | Hodsock Priory  |
| + '18                    | 106      | '34               | 20          | 27 | 31'38                 | 28'97     | -2'41                | 92       | 34'73                  | Macclesfield    |
| + '67                    | 121      | '81               | 20          | 26 | 29'60                 | 27'03     | -2'57                | 91       | 32'70                  | Southport       |
| +2'65                    | 143      | 1'43              | 20          | 27 | 54'74                 | 52'23     | -2'51                | 95       | 61'49                  | Arncliffe       |
| - '27                    | 88       | '44               | 16          | 17 | 24'60                 | 20'45     | -4'15                | 83       | 26'87                  | Ribston Hall    |
| - '17                    | 93       | '48               | 10          | 22 | 24'10                 | 18'93     | -5'17                | 79       | 26'42                  | Hull            |
| -1'32                    | 50       | '19               | 26          | 19 | 25'48                 | 25'68     | + '20                | 101      | 27'94                  | Newcastle       |
| - '10                    | 99       | 1'50              | 20          | 26 | 114'34                | 110'00    | -4'34                | 96       | 129'48                 | Seathwaite      |
| +1'87                    | 146      | '57               | 5, 9        | 28 | 37'58                 | 43'13     | +5'55                | 115      | 42'28                  | Cardiff         |
| - '34                    | 93       | '77               | 9           | 25 | 41'63                 | 49'88     | +8'25                | 120      | 46'81                  | Haverfordwest   |
| +2'52                    | 156      | 1'22              | 20          | 26 | 40'80                 | 53'42     | +12'62               | 131      | 45'46                  | Gogerddan       |
| + '44                    | 114      | '68               | 12          | 24 | 27'52                 | 29'56     | +2'04                | 107      | 30'36                  | Llandudno       |
| +1'47                    | 134      | '90               | 2           | 24 | 38'63                 | 44'01     | +5'38                | 114      | 43'47                  | Cargen          |
| -1'26                    | 61       | '28               | 10          | 19 | 30'93                 | 23'62     | -7'31                | 76       | 33'76                  | Marchmont       |
| +2'49                    | 148      | 1'25              | 15          | 28 | 44'29                 | 41'17     | -3'12                | 93       | 49'77                  | Girvan          |
| +1'46                    | 140      | '75               | 2           | 23 | 32'02                 | 31'50     | - '52                | 98       | 35'97                  | Glasgow         |
| +4'80                    | 165      | 1'32              | 19          | 26 | 60'10                 | 63'39     | +3'29                | 105      | 68'67                  | Inveraray       |
| +2'29                    | 137      | '89               | 19          | 25 | 49'98                 | 49'23     | - '75                | 99       | 56'57                  | Quinish         |
| - '83                    | 68       | '53               | 2           | 20 | 25'97                 | 21'95     | -4'02                | 85       | 28'64                  | Dundee          |
| -1'55                    | 59       | '27               | 2           | 20 | 31'80                 | 28'70     | -3'10                | 90       | 34'93                  | Braemar         |
| -1'64                    | 50       | '43               | 6           | 15 | 29'30                 | 23'72     | -5'58                | 81       | 32'73                  | Aberdeen        |
| - '33                    | 87       | '31               | 30          | 12 | 26'80                 | 20'30     | -6'50                | 76       | 29'33                  | Cawdor          |
| +2'81                    | 162      | 1'20              | 2           | 26 | 38'91                 | 39'69     | + '78                | 102      | 44'53                  | Fort Augustus   |
| +5'47                    | 162      | 1'82              | 2           | 26 | 74'07                 | 76'59     | +2'52                | 103      | 83'93                  | Bendamph        |
| + '75                    | 123      | '48               | 30          | 18 | 28'81                 | 22'05     | -6'76                | 77       | 31'90                  | Dunrobin Castle |
| + '15                    | 105      | '31               | 18          | 22 | 26'77                 | 20'97     | -5'80                | 78       | 29'88                  | Wick            |
| +1'94                    | 135      | '90               | 12          | 27 | 47'89                 | 54'24     | +6'35                | 113      | 54'81                  | Killarney       |
| - '18                    | 95       | '65               | 20          | 19 | 35'25                 | 38'76     | +3'51                | 110      | 39'57                  | Waterford       |
| + '84                    | 122      | '56               | 7           | 22 | 35'09                 | 39'04     | +3'95                | 111      | 39'43                  | Castle Lough    |
| +1'18                    | 126      | '82               | 2           | 28 | 41'49                 | 47'23     | +5'74                | 114      | 46'52                  | Ennistymon      |
| + '47                    | 114      | 1'14              | 9           | 18 | 31'57                 | 32'34     | + '77                | 102      | 34'99                  | Courtown Ho.    |
| + '40                    | 112      | '52               | 9           | 22 | 32'51                 | 38'95     | +6'44                | 120      | 35'92                  | Abbey Leix      |
| - '40                    | 85       | '51               | 7           | 21 | 25'41                 | 26'98     | +1'57                | 106      | 27'68                  | Dublin          |
| - '31                    | 31       | '58               | 7           | 24 | 32'76                 | 35'12     | +2'36                | 107      | 36'15                  | Mullingar       |
| +2'16                    | 137      | 2'04              | 23          | 26 | 46'76                 | 54'68     | +7'92                | 117      | 52'87                  | Ennisceoe       |
| + '69                    | 114      | 1'03              | 23          | 27 | 43'48                 | 46'40     | +2'92                | 107      | 48'90                  | Cong            |
| +1'24                    | 131      | 1'10              | 23          | 26 | 38'37                 | 40'46     | +2'09                | 105      | 42'71                  | Markree         |
| + '55                    | 114      | '84               | 11          | 21 | 35'14                 | 37'16     | +2'02                | 106      | 38'91                  | Seaforde        |
| + '73                    | 119      | '87               | 15          | 25 | 33'69                 | 27'95     | -5'74                | 83       | 37'56                  | Dundarave       |
| + '16                    | 104      | '47               | 7           | 25 | 35'47                 | 36'17     | + '70                | 102      | 39'38                  | Omagh           |

## SUPPLEMENTARY RAINFALL, NOVEMBER, 1913.

| Div.  | STATION.                      | Rain<br>inches. | Div.   | STATION.                      | Rain<br>inches. |
|-------|-------------------------------|-----------------|--------|-------------------------------|-----------------|
| II.   | Warlingham, Redvers Road..    | 3·29            | XI.    | Lligwy .....                  | 5·05            |
| „     | Ramsgate .....                | 2·45            | „      | Douglas .....                 | 5·99            |
| „     | Hailsham .....                | 4·80            | XII.   | Stoneykirk, Ardwell House...  | 5·40            |
| „     | Totland Bay, Aston House...   | 3·64            | „      | Dalry, The Old Garroch.....   | 10·21           |
| „     | Stockbridge, Ashley..         | 2·27            | „      | Beattock, Kinnelhead .....    | 8·07            |
| „     | Grayshott .....               | 3·21            | „      | Langholm, Drove Road .....    | 7·06            |
| „     | Caversham, Rectory Road ...   | 2·27            | XIII.  | Meggat Water, Cramilt Lodge   | 7·11            |
| III.  | Harrow Weald, Hill House...   | 2·64            | „      | North Berwick Reservoir.....  | 1·27            |
| „     | Pitsford, Sedgebrook.....     | 2·30            | „      | Edinburgh, Royal Observaty.   | 1·97            |
| „     | Woburn, Milton Bryant.....    | 2·36            | XIV.   | Maybole, Knockdon Farm ...    | 5·76            |
| „     | Chatteris, The Priory.....    | ·99             | XV.    | Ballachulish House .....      | 11·34           |
| IV.   | Colchester, Hill Ho., Lexden  | 2·75            | „      | Campbeltown, Witchburn ..     | 6·79            |
| „     | Newport, Belmont House .....  | ...             | „      | Holy Loch, Ardnadam.....      | 12·16           |
| „     | Ipswich, Rookwood, Copdock    | 2·93            | „      | Islay, Eallabus .....         | 5·73            |
| „     | Blakeney .....                | 1·90            | „      | Tiree, Cornaigmore .....      | 6·37            |
| „     | Swaffham .....                | 2·21            | XVI.   | Dollar Academy .....          | 5·25            |
| V.    | Bishops Cannings .....        | 2·29            | „      | Balquhiddier, Stronvar.....   | ...             |
| „     | Winterbourne Steepleton.....  | ...             | „      | Glenlyon, Meggernie Castle..  | 9·70            |
| „     | Ashburton, Druid House .....  | 6·74            | „      | Blair Atholl .....            | 3·70            |
| „     | Cullompton .....              | 3·92            | „      | Coupar Angus .....            | 2·05            |
| „     | Lynmouth, Rock House .....    | 6·47            | „      | Montrose, Sunnyside Asylum.   | 1·37            |
| „     | Okehampton, Oaklands... ..    | 5·96            | XVII.  | Alford, Lynturk Manse .....   | 1·06            |
| „     | Hartland Abbey.....           | 4·65            | „      | Fyvie Castle .....            | 1·63            |
| „     | Probus, Lamellyn.....         | 5·03            | „      | Keith Station .....           | 1·69            |
| „     | North Cadbury Rectory.....    | 3·07            | XVIII. | Alvey Manse.....              | ...             |
| VI.   | Clifton, Pembroke Road.....   | 3·32            | „      | Loch Quoich, Loan .....       | 37·25           |
| „     | Ross, The Graig .....         | 3·36            | „      | Drumnadrochit .....           | 4·56            |
| „     | Shifnal, Hatton Grange.....   | 2·38            | „      | Skye, Dunvegan .....          | 11·56           |
| „     | Droitwich .....               | 3·02            | „      | N. Uist, Lochmaddy .....      | ...             |
| „     | Blockley, Upton Wold.....     | 3·24            | „      | Glencarron Lodge .....        | 18·40           |
| VII.  | Market Overton.....           | 2·89            | XIX.   | Invershin .....               | 5·42            |
| „     | Market Rasen .....            | 2·06            | „      | Melvich .....                 | 4·91            |
| „     | Bawtry, Hesley Hall .....     | 1·81            | „      | Loch Stack, Ardochullin ..... | 14·20           |
| „     | Derby, Midland Railway.....   | 2·39            | XX.    | Skibbereen Rectory .....      | 5·66            |
| „     | Buxton .....                  | 5·17            | „      | Dunmanway, The Rectory ..     | 7·67            |
| VIII. | Nantwich, Dorfold Hall .....  | 2·26            | „      | Glanmire, Lota Lodge, No. 1   | 4·92            |
| „     | Chatburn, Middlewood .....    | 4·29            | „      | Mitchelstown Castle.....      | 5·18            |
| „     | Carmel, Flookburgh .....      | 4·60            | „      | Darrynane Abbey.....          | 6·14            |
| IX.   | Langsett Moor, Up. Midhope    | 3·23            | „      | Clonmel, Bruce Villa .....    | 4·40            |
| „     | Scarborough, Scalby .....     | 2·08            | „      | Newmarket-on-Fergus, Fenloe   | 4·25            |
| „     | Ingleby Greenhow .....        | 1·79            | XXI.   | Laragh, Glendalough .....     | 3·07            |
| „     | Mickleton .....               | 3·70            | „      | Ballycumber, Moorock Lodge    | 2·58            |
| X.    | Bellingham, High Green Manor  | 2·74            | „      | Balbriggan, Ardgillan .....   | 2·69            |
| „     | Ilderton, Lilburn Cottage ... | 1·76            | XXII.  | Woodlawn .....                | 3·95            |
| „     | Keswick, The Bank.....        | 6·24            | „      | Westport, St. Helens .....    | 6·18            |
| XI.   | Llanfrechfa Grange .....      | 5·04            | „      | Dugort, Slievemore Hotel ...  | 7·11            |
| „     | Treherbert, Tyn-y-waun .....  | 15·64           | „      | Mohill Rectory .....          | 3·50            |
| „     | Carmarthen, The Friary .....  | 6·40            | XXIII. | Enniskillen, Portora .....    | 4·29            |
| „     | Castle Malgwyn [Llechryd]...  | 5·10            | „      | Dartrey [Cootehill] .....     | 3·58            |
| „     | Crickhowell, Tal-y-maes ..... | 5·80            | „      | Warrenpoint, Manor House ..   | 3·62            |
| „     | New Radnor, Ednol .....       | 3·75            | „      | Banbridge, Milltown .....     | 2·83            |
| „     | Birmingham WW., Tyrmynydd     | 8·56            | „      | Belfast, Cave Hill Road ..... | 4·32            |
| „     | Lake Vyrnwy .....             | 6·51            | „      | Glenarm Castle.....           | 4·83            |
| „     | Llangyhanfal, Plâs Draw.....  | 2·65            | „      | Londonderry, Creggan Res...   | 4·19            |
| „     | Dolgelly, Bryntirion.....     | 7·88            | „      | Dunfanaghy, Horn Head ...     | 6·51            |
| „     | Bettws-y-Coed, Tyn-y-bryn...  | 6·50            | „      | Killybegs .....               | 8·65            |

## METEOROLOGICAL NOTES ON NOVEMBER, 1913.

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.—Fair to dull weather with frequent light E. Unusually mild throughout the month, the mean temp.  $47^{\circ}\cdot8$  being  $4^{\circ}\cdot3$  above the average, and the highest for November in the 56 years' record, excepting only November, 1881, when it was  $48^{\circ}\cdot8$ . Though persistently high, temp. was never extreme for November, there being only 4 days with shade max. below  $50^{\circ}$ , but no day on which  $60^{\circ}$  was reached. Duration of sunshine  $54\cdot5^*$  hours, and of R  $43\cdot9$  hours. Evaporation  $\cdot36$  in. Shade max.  $59^{\circ}\cdot9$  on 11th; min.  $29^{\circ}\cdot8$  on 23rd. F 0, f 3.

TENTERDEN.—A warm month and wet in the first half. Duration of sunshine  $78\cdot5^{\dagger}$  hours. Shade max.  $59^{\circ}\cdot5$  on 17th; min.  $31^{\circ}\cdot5$  on 23rd. F 1, f 6.

TOTLAND BAY.—Mean temp.  $50^{\circ}\cdot2$  and the warmest November in 28 years, the nearest approach being November, 1894, with mean temp.  $49^{\circ}\cdot6$ . Duration of sunshine  $87\cdot3^*$  hours. Shade max.  $58^{\circ}\cdot6$  on 11th; min.  $34^{\circ}\cdot0$  on 23rd. F 0, f 1.

IPSWICH, COPDOCK.—The mildest November ever recorded here. The first half of the month was wet, but the duration of sunshine  $87\cdot6^*$  hours, was the greatest in 11 years for November. Mean temp.  $46^{\circ}\cdot8$ . Shade max.  $59^{\circ}\cdot0$  on 2nd; min.  $30^{\circ}\cdot0$  on 23rd. F 1, f 8.

POLAPIT TAMAR.—Unusually mild though wet, with a good deal of wind. Shade max.  $57^{\circ}\cdot9$  on 9th and 10th; min.  $29^{\circ}\cdot2$  on 23rd. F 2, f 7.

NORTH CADBURY.—No extremes of warmth, but entire absence of marked cold; a damp November although wind was above and cloud below the average. Shade max.  $61^{\circ}\cdot0$  on 1st and 2nd; min.  $31^{\circ}\cdot0$  on 23rd. F 1, f 9.

DROITWICH.—Very mild month. Rambler roses, primroses, fuchsias, etc., were in flower on November 30th.

HODSOCK PRIORY.—Shade max.  $58^{\circ}\cdot1$  on 17th; min.  $28^{\circ}\cdot2$  on 23rd. F 4, f 14.

SOUTHPORT.—An unusually stormy month. Duration of sunshine  $52\cdot7^*$  hours, and of R  $78\cdot1$  hours. Evaporation  $\cdot31$  in. Mean temp.  $47^{\circ}\cdot5$ , or  $4^{\circ}\cdot2$  above the average. Shade max.  $56^{\circ}\cdot0$  on 2nd and 16th; min.  $35^{\circ}\cdot0$  on 23rd. F 0, f 7.

HULL.—Mild throughout with some fine sunny days and others very dull, often with mist. Duration of sunshine  $46\cdot2^*$  hours. Shade max.  $58^{\circ}\cdot0$  on 2nd and 17th; min.  $33^{\circ}\cdot0$  on 10th. F 0, f 8.

HAVERFORDWEST.—Duration of sunshine  $72\cdot3^*$  hours. Shade max.  $66^{\circ}\cdot9$  on 14th; min.  $39^{\circ}\cdot0$  on 22nd.

LLANDUDNO.—Shade max.  $58^{\circ}\cdot0$  on 10th; min.  $37^{\circ}\cdot0$  on 23rd. F 0, f 0.

CRAMILT LODGE.—Heavy R on night of 2nd, the total being  $2\cdot53$  in., most of which fell between 6 p.m. on 2nd and 3 a.m. on 3rd.

EDINBURGH.—Shade max.  $54^{\circ}\cdot9$  on 17th; min.  $34^{\circ}\cdot0$  on 9th. F 0, f 8.

INVERARAY.—A wet month, R falling on all but 4 days, but without any such great storms as in November of the last two years.

LYNTURK.—The features of the month were the low R and the high winds which often approached gale force, and the general mildness of the latter half of the month. Shade max.  $59^{\circ}\cdot5$  on 27th; min.  $20^{\circ}\cdot4$  on 5th. F 8.

LOCH STACK.—Duration of sunshine  $28\cdot1^*$  hours.

DARRYNANE.—A wet but mild month. The last 4 days were foggy and close.

DUBLIN.—An open windy month with frequent R and constant winds from S.W. and W. Mean temp.  $47^{\circ}\cdot8$  or  $2^{\circ}\cdot4$  above the average. Shade max.  $57^{\circ}\cdot1$  on 17th; min.  $35^{\circ}\cdot3$  on 22nd. F 0, f 1.

MARKREE.—Duration of sunshine  $54\cdot4$  hours. Shade max.  $57^{\circ}\cdot0$  on 10th and 28th; min.  $28^{\circ}\cdot0$  on 1st and 22nd. F 3, f 9.

\* Campbell-Stokes.

† Jordan.

## Climatological Table for the British Empire, June, 1913.

| STATIONS.<br><br>(Those in italics are<br>South of the Equator.) | Absolute. |       |          |       | Average. |       |               |             | Absolute.       |                   | Total Rain |       | Aver.<br>Cloud. |
|------------------------------------------------------------------|-----------|-------|----------|-------|----------|-------|---------------|-------------|-----------------|-------------------|------------|-------|-----------------|
|                                                                  | 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                                            | 85°·4     | 17    | 43°·6    | 9     | 72°·2    | 51°·2 | 50°·3         | 0-100<br>70 | 130°·3          | 41°·0             | ·58        | 7     | 5·7             |
| Malta ... ..                                                     | ...       | ...   | ...      | ...   | ...      | ...   | ...           | ...         | ...             | ...               | ...        | ...   | ...             |
| Lagos ... ..                                                     | 89°·5     | 14    | 71°·5    | 4     | 86°·7    | 75°·1 | 74°·2         | 78          | 154°·5          | 69°·4             | 16·87      | 20    | 6·3             |
| Cape Town ... ..                                                 | 78°·9     | 25    | 42°·0    | 10    | 64°·1    | 50°·5 | 50°·7         | 80          | ...             | ...               | 3·35       | 14    | 5·9             |
| Natal, Durban ... ..                                             | 71°·0     | 4,6   | 50°·0    | 30    | 65°·3    | 54°·8 | 52°·4         | 75          | ...             | ...               | 1·03       | 4     | 2·0             |
| Johannesburg ... ..                                              | 67°·5     | 4     | 31°·5    | 8     | 60°·6    | 41°·6 | 33°·8         | 61          | 121°·7          | 30°·7             | 0·0        | 0     | 1·2             |
| Mauritius ... ..                                                 | 80°·0     | 1     | 55°·7    | *13   | 75°·9    | 62°·9 | 61°·9         | 79          | 145°·7          | 46°·9             | 10·84      | 16    | 5·3             |
| Bloemfontein ... ..                                              | 68°·5     | 1     | 28°·7    | 9     | 62°·1    | 34°·9 | 30°·8         | 65          | ...             | ...               | ·11        | 3     | 3·8             |
| Calcutta... ..                                                   | 95°·0     | 16    | 74°·0    | 15    | 87°·3    | 77°·9 | 77°·2         | 87          | ...             | 72°·0             | 31·15      | 21    | 8·7             |
| Bombay... ..                                                     | 95°·0     | 4     | 74°·4    | 23    | 87°·6    | 79°·8 | 77°·6         | 82          | 142°·5          | 69°·8             | 25·88      | 21    | 7·6             |
| Madras ... ..                                                    | 105°·3    | 20    | 78°·9    | 4     | 100°·2   | 82°·7 | 71°·6         | 61          | 139°·6          | 78°·7             | ·13        | 7     | 5·3             |
| Colombo, Ceylon ... ..                                           | 88°·1     | 9     | 73°·3    | 6, 12 | 86°·2    | 77°·1 | 75°·0         | 81          | 151°·8          | 70°·1             | 4·96       | 13    | 6·9             |
| Hongkong ... ..                                                  | 88°·2     | 2     | 70°·6    | 8     | 85°·6    | 77°·6 | 75°·5         | 83          | ...             | ...               | 16·04      | 23    | 7·5             |
| Sydney ... ..                                                    | 63°·7     | 23    | 41°·3    | 9     | 56°·4    | 47°·9 | 45°·6         | 80          | 106°·0          | 32°·2             | 11·22      | 25    | 6·8             |
| Melbourne ... ..                                                 | 61°·6     | 29    | 31°·6    | 9     | 56°·3    | 43°·8 | 42°·6         | 74          | 96°·9           | 26°·6             | 1·43       | 10    | 5·6             |
| Adelaide ... ..                                                  | 66°·6     | 28    | 32°·8    | 12    | 60°·3    | 41°·7 | 41°·6         | 71          | 127°·0          | 22°·9             | ·58        | 6     | 4·4             |
| Perth ... ..                                                     | 74°·2     | 6     | 43°·8    | 17    | 64°·9    | 50°·7 | 50°·6         | 77          | 134°·8          | 34°·9             | 8·64       | 18    | 6·2             |
| Coolgardie ... ..                                                | 73°·2     | 1     | 35°·0    | 17    | 64°·5    | 44°·1 | 40°·6         | 55          | 135°·0          | 27°·0             | ·60        | 6     | 4·9             |
| Hobart, Tasmania ... ..                                          | 59°·7     | 19    | 29°·3    | 12    | 52°·0    | 40°·5 | 38°·5         | 72          | 109°·0          | 24°·4             | 1·26       | 13    | 5·7             |
| Wellington ... ..                                                | 62°·2     | 4     | 35°·0    | 30    | 54°·4    | 43°·4 | 41°·7         | 77          | 108°·8          | 26°·0             | 2·02       | 17    | 6·3             |
| Auckland ... ..                                                  | 64°·5     | 3     | 36°·5    | 26    | 55°·2    | 44°·4 | 45°·7         | 86          | 108°·0          | 34°·0             | 1·47       | 14    | 4·9             |
| Jamaica, Kingston ... ..                                         | 90°·7     | 23    | 70°·8    | 5     | 88°·4    | 73°·2 | 69°·9         | 74          | ...             | ...               | 1·38       | 4     | 5·6             |
| Grenada ... ..                                                   | 88°·0     | 8     | 72°·0    | 25    | 84°·1    | 74°·5 | ...           | 77          | 137°·0          | ...               | 6·55       | 23    | 6·0             |
| Toronto ... ..                                                   | 95°·0     | 16    | 38°·0    | 8     | 77°·0    | 53°·0 | 49°·0         | 58          | ...             | ...               | 1·35       | 7     | 3·3             |
| Fredericton ... ..                                               | 83°·0     | 11    | 34°·0    | 10    | 71°·0    | 45°·0 | ...           | 62          | ...             | ...               | 1·88       | 12    | 4·9             |
| St. John, N.B. ... ..                                            | 74°·0     | 22    | 41°·0    | 10    | 63°·0    | 48°·0 | 45°·0         | 67          | ...             | ...               | ·56        | 10    | 4·6             |
| Edmonton, Alberta ... ..                                         | 86°·2     | 9     | 33°·0    | 3     | 70°·0    | 47°·9 | ...           | 67          | 139°·4          | 20°·0             | 2·88       | 17    | 5·6             |
| Victoria, B.C. ... ..                                            | 78°·0     | 2     | 43°·0    | 6     | 69°·0    | 50°·0 | 48°·0         | 70          | ...             | ...               | 1·05       | 7     | 6·2             |

\* and 19.

*Johannesburg.*—Bright sunshine 282·0 hours.*Mauritius.*—Mean temp. of air 0°·1, dew point 0°·9, and R 8·26 in. above averages. Mean hourly velocity of wind 11·0, or 0·2 below average.

COLOMBO.—Mean temp. of air 81°·7, same as average, dew point 0°·2 above, and R 2·95 in. below, averages. Mean velocity of wind 5·7 miles per hour. TSS on 2 days.

HONGKONG.—Mean temp. of air 81°·2. Mean hourly velocity of wind 9·6 miles. Bright sunshine 181·5 hours.

*Sydney.*—A wet month, H on 2 days, heavy rains and storms.*Melbourne.*—Mean temp. of air 0°·3 below, and R ·68 in. below, averages.*Adelaide.*—Mean temp. of air 2°·4 below, and R 2·52 in. below, averages.*Perth.*—Temp. above average.*Coolgardie.*—Temp. of air 2°·0 above, and R half an inch below, averages.*Hobart.*—Mean temp. of air 0°·6 below, and R 0·96 in. below, averages.*Wellington.*—Mean temp. of air 0°·5 below, and R 3·06 in. below, averages.

Bright sunshine 115·1 hours. F on 8 days, H on 2 days.

*Auckland.*—A dry June, with one exception the driest ever recorded. R less than a third of the average and mean temp. 0°·3 below average. Bright sunshine above average.

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## **William Dillworth Howard, F.R.C.**

1832—9TH DECEMBER, 1913.

WE regret to announce the death in London, at the age of 81, of William Dillworth Howard, son of John Eliot Howard, F.R.S., and a grandson of the well-known meteorologist, Luke Howard. Mr. Howard was one of the contributors to "British Rainfall" in 1860-61, having made observations at Tottenham from 1850 to 1864.

By his death the small band of surviving original Observers is reduced to eight. After his school education he studied chemistry under the late Prof. A. Williamson, F.R.S., at the Birkbeck Laboratory of University College, and was for many years a Fellow of the Chemical Society, and also one of the original members of the Institute of Chemistry. For nearly half a century Mr. Howard displayed a keen interest in the work of the British Rainfall Organization, to the funds of which he subscribed liberally.

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## **Edmund Douglas Archibald, M.A.**

1851—30TH NOVEMBER, 1913.

THE name of Douglas Archibald will be chiefly remembered in connection with his pioneer work in modern upper air research. In 1882 he revived the use of kites for meteorological observations, and at the same time brought forward a comprehensive programme for the exploration of the air by means of kites, which has since been more than realised. This scheme was outlined at a meeting of the Royal Meteorological Society on November 15th, 1882, but during the next three or four years Mr. Archibald's experiments—in the absence of meteorographs—were confined to ascertaining the increase of wind velocity with elevation. To effect this, four registering anemometers were attached at different points on the kite wire, and thus differential measurements of the velocity of the wind up to a height of 1,200 feet were obtained. Archibald was the first to substitute steel pianoforte wire for the string, the weight, size and cost of the line being thereby diminished. In 1887 he invented the captive kite balloon, and in the same year took the first photograph from a kite.



Mr. Archibald was elected a Fellow of the Royal Meteorological Society in 1877, and served on the Council from 1881 to 1885, being Vice-President in 1883 and 1884. He was an M.A. of Oxford University and a Corresponding Member of the German Meteorological Society. His published works include a portion of the well-known "Report of Krakatoa Eruption," to which he contributed in collaboration with Rollo Russell the chapter on "Sun-glows." He also wrote "Rainfall of the World in connection with Sun-spots," a monograph on the "Climate of Calcutta," being one of the *Indian Meteorological Memoirs*, and "The Story of the Earth's Atmosphere." He was for some time, about 1877, Professor of Mathematics under the Bengal Education Department at Bankipore, and at a later period held a chair in the University of Calcutta.

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### ROYAL METEOROLOGICAL SOCIETY.

THE second meeting of this Society for the Session was held on Wednesday evening, the 17th December, at the Institution of Civil Engineers, Great George Street, Westminster, S.W., Mr. C. J. P. Cave, President, in the chair.

Mr. Carle Salter, Assistant Director of the British Rainfall Organisation, read a paper, by Mr. Mossman and himself, on the "Great Rainstorm at Doncaster, September 17th, 1913," in the course of which he remarked that on the day in question during a period of disturbed weather characterised by heavy rains in widely separated localities, a remarkably heavy and, in its maximum phase, extremely local fall of rain took place at Doncaster. The storm lasted 14 hours, during which more than 4 inches of rain fell at nine stations, four stations reporting 5 inches or more. The maximum fall observed was 5.50 in. at Brodsworth Gardens, and while more than 5 inches fell over an area of only 27 square miles, no less than 2336 miles experienced a fall exceeding half-an-inch. The area of the storm was roughly oval in shape, the isohyets increasing steadily to a single focus, and so far as could be seen the contour of the land exercised no influence on the outline of the isohyets. The paper dealt in some detail with the rate of fall of the rain at various places in Doncaster and vicinity, from which it was shown that one of the most pronounced features of the storm was the occurrence of very heavy downpours of short duration throughout the day.

There was nothing in the appearance of the weather charts to explain the special local nature of the disturbance in the neighbourhood of Doncaster. An Observer 18 miles south-east of Doncaster reported hail at 9.30 a.m., and further noted that the clouds were moving slowly from the east in the upper, and from the north-west in the lower atmosphere. Thunder and lightning were continuous all day in the central area. The paper concluded with a synopsis of previous remarkable rains experienced in the British Isles.

The President remarked upon the difference in direction of the upper air and surface air currents, and said he had himself experienced a fall of 4 inches of rain in 12 hours in the West Indies when there was a different current above than below.

Mr. F. J. Brodie said such a storm was the despair of the forecaster. East and north-east winds were usually regarded as dry winds, but he cited many instances of heavy rain or snow storms when the wind had been in the N.E. quarter. If a south wind was blowing over a wind between E. and N. there must be a cooling effect resulting in heavy rainfall.

Col. Rawson and Mr. Mellish also took part in the discussion.

"Recent Studies of Snow in the United States" formed the subject of a paper sent by Dr. T. E. Church, Director of the Mount Rose Meteorological Observatory, University of Nevada, U.S.A. A description was given of the various types of snow samplers, weighers and gauges in use, and various aspects of the snow problem were considered, such as the density and water equivalent, the evolution of snow in the field, and the relation of mountains and forests to the conservation of snow.

A paper on "The Meteorological Conditions of an Ice-sheet and their Bearing on the Desiccation of the Globe" was communicated by Mr. C. E. P. Brooks, B.Sc. The first part of the paper dealt with the meteorological conditions over existing ice-sheets and summarised the views of various authorities regarding the distribution of barometric pressure in the Polar regions, from which it was concluded that an extensive ice-sheet will give rise to a permanent anticyclone. The precipitation in a glacial anticyclone was then considered, and found rarely to exceed the equivalent of ten inches of rain, and it was further shown that over a large ice-sheet evaporation is very small, so that the glaciation will increase with quite a moderate snowfall. It was inferred that during the glacial period permanent anticyclones covered the areas occupied by similar ice-sheets, the maximum extent of glaciation taking place simultaneously in different regions and coinciding over the areas without glaciers, in a period of greater rainfall than that which prevails now. A general decrease in temperature would lead to a decrease in the amount of evaporation and hence of precipitation, so that while the general precipitation may have been somewhat less than now taking the globe as a whole, over the ice-sheets so little fell that the remainder falling upon the unglaciated areas rendered these considerably moister than now.

Since the ice-age reached its climax, desiccation has advanced with the recession of the ice. Slight interruptions have taken place, a striking example being from the ninth to the thirteenth centuries when there occurred a cold period in the north, which was associated in the more southerly regions with an increased rainfall.

Dr. W. N. Shaw, initiating the discussion, said that there was one point that greatly interested him, that was the question of the

Antarctic anticyclone. Dr. Hildebrandsson held that the entire region was occupied by a vast cyclonic depression, and M. Teisserenc de Bort had shown that in the upper air, the north and south poles were a sort of focus of cyclonic systems. The speaker had suggested that the surface circulation at the poles was not the same as it was above. His impression was that at a height of 4 kilometers (2½ miles) the circulation was cyclonic, but that near the surface, somewhere about the Antarctic Circle the immense masses of cold air produced a circulation in an opposite direction. He thought that the polar anticyclone was, in fact, partly the creation of meteorologists, and partly due to the reduction of the pressure to sea level. Dr. Shaw suggested that the flowing down of cooled air from the great height of 15,000 feet to the lower levels would at sea-level set up an anticyclonic circulation, while the blizzards so characteristic of the Antarctic were more likely to be cascades of air, than specimens of that circulation.

Captain Lyons said that in N.E. Africa all signs of a period of heavy rain, if any ever existed, had long since disappeared.

Mr. E. Gold said that Dr. Church, in his paper, showed that between temperatures of 25° and 30° F. the evaporation in 12 hours was about .10 in. He thought that in taking snow depths as a measurement of rainfall it was difficult to distinguish between recent falls and accumulated snow, and Mr. Brooks had perhaps not taken sufficient account of evaporation of snow in the period of observation.

Colonel Rawson remarked that he had collected data of, and himself experienced, heavy rain in the centre of an anti-cyclone.

Mr. Hooker, Mr. Tripp and Mr. Bryant also took part in the discussion.

The following new fellows were elected:—Mr. Harris Booth, B.A., Major W. S. Brancker, Mr. A. Samler Brown, Mrs. Lucy Cave, Mr. Henry Coanda, Mr. Alexander Gross, Mr. J. M. Hatfield, Lieut. F. Vesey Holt, Mr. James Hutcheon, M.A., Lieut. J. R. F. Lecky, Major H. Musgrave, The Lady Tredegar, Mr. W. H. Weldon, C.V.O., Staff-Surgeon H. V. Wells, Captain H. F. Wood.

## SCOTTISH METEOROLOGICAL SOCIETY.

THE Annual Business Meeting of the Society was held in the Goold Hall, Edinburgh, on the 17th December, 1913, Mr. T. Mackay Bernard, of Dunsinnan, B.Sc., F.R.S.E., President, in the chair.

The proceedings opened with the reading of the Report from the Council, which contained the following important announcement:—  
“In their Report to the Society in December, 1912, the Council stated that they had in March, 1912, lodged an application with the Registrar-General for Scotland for a grant sufficient to defray the entire cost of the reports supplied to him by the Society. That

application was forwarded by the Registrar-General to the Scottish Office, and by the Secretary of State for Scotland to the Treasury, and was finally referred to the Meteorological Committee, London, which is responsible for the expenditure of the Parliamentary grant for meteorology. Dr. Shaw, as Chairman of this Committee and Director of the Meteorological Office, visited Edinburgh, and discussed the situation with a Committee of the Council, and ultimately an arrangement was come to between the Council on the one hand, as representing the Society, and the Meteorological Committee on the other hand. It was agreed that as regards the publication of statistics and the supply of information to the public the Society should enter into close relations with the Meteorological Office, confining its independent activities to the furthering of what may be called the primary purposes of the Society—that is, the encouragement of research and the publication of scientific papers. On the financial side, an annual payment of £100, which has been made to the Society since 1894 in consideration of the reports supplied to the Registrar-General for Scotland, will be continued, and, in addition, an annual grant of £350 will be made by the Meteorological Committee. In consideration of these payments from Government sources the Society will maintain a Public Office in Edinburgh, and will supply to the Registrar-General for Scotland and to the Meteorological Office, London, the reports and observations required for their purposes."

The Chairman, in moving the adoption of the report, called special attention to those paragraphs dealing with the financial position of the Society and its new relations to the Meteorological Office. They would, he said, have noticed that Government grants of the total annual amount of £450 would be available in future, and that in consideration of those grants the Society was under obligation to maintain an office and staff, and to furnish such reports and statistical information for the Scottish area as might be required by the Meteorological Office and the Department of the Registrar-General for Scotland. In addition, the public would have, under suitable regulations, a right of access to the original returns on which such reports were based. They would have noted also that a Committee, composed of three representatives of the Society and three representatives of public departments, had been constituted for the administration of those grants. The allocation of a considerable sum of Government money naturally involved some new body of control, and advantages might be expected to result from the interchange of views amongst the members of the new Committee as to the ways in which the information available might be made most useful to the public. It was a matter of gratification to the Council that the Society's services to the public over a long period of years had received recognition, and that the Society's office was now, as regarded one side of its activities, to fill the place of a public Central Office for Scotland. It remained for the Society as a Society

to devote its energies to the promotion and encouragement of scientific research.

The following were appointed office-bearers and Council for the ensuing twelve months :—

*President*--J. Mackay Bernard, of Dunsinnan, B.Sc., F.R.S.E. ; *Vice-Presidents*—Gilbert Thomson, Professor R. A. Sampson, D.Sc., F.R.S. ; *Council*—G. G. Chisholm, M. McCallum Fairgrieve, Professor A. Crum Brown, Dr. J. R. Milne, T. S. Muir, Dr. C. G. Knott, James Watt, W.S., Dr. A. Crichton Mitchell, Sir R. P. Wright ; *Hon. Secretaries*—Dr. R. T. Omond, E. M. Wedderburn, D.Sc., W.S. ; *Hon. Treasurer*—W. B. Wilson, W.S.

Thereafter Dr. E. M. Wedderburn read a paper "On the Appearance of the Surface of Fresh-Water Lochs in Calm Weather," in the course of which he discussed the appearance of oily patches and of scum, which recently formed the subject of correspondence in *The Scotsman*. Samples of scum collected on Lochs Earn and Voil, and analysed by Professor James Ritchie, seemed to show conclusively that the cause of the scum was not soot carried by winds from large cities, and the conclusion came to was that the scum was due to decomposing matter resting on the bottom and shores of lochs, agitated and brought to the surface during stormy weather by wind-produced currents. The oily patches so often seen on the surface of fresh water, and which were often supposed to be an indication of changeable and wet weather, appeared to be caused by oils coming from various sources of pollution, frequently from the fats set free on the decomposition of organic matter. They were most frequently seen in changeable weather, as during settled weather, either fair or foul, the oils were evenly distributed over the surface of the water, and only when winds were light and variable did the patches make their appearance.

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SOUTHERN HEMISPHERE SEASONAL CORRELATIONS.

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

(of the Argentine Meteorological Office).

Seventh Article—(concluded).

IN conclusion, as regards the practical value of this class of research, some glimpses of which have been obtained in the foregoing series of articles, while it certainly opens up prospects of the possibility of long range weather forecasts in some instances, yet until we obtain some definite knowledge regarding the physical processes by which the observed correlations are brought about and the permanence or otherwise of the leading features, we cannot with any degree of confidence utilise the information. Are the correlations such as that observed from 1876 to 1894 between the Trinidad rainfall from April to September and that at Ajo for the following six months, fortuitous

phenomena or subject to a cyclical repetition? If so, will the next period of agreement be of the same length as that already observed? Time only can settle such questions, unless we can in the meanwhile obtain a clue as to what is at the root of the matter. It is almost certain that the inter-action is world-wide, but even to-day we have not weather data for many regions to enable us to investigate the meteorological inter-relations existing between regions far distant.

We must, therefore, make an examination of the normal meteorological conditions, based on world maps deduced from the greatly extended, improved and homogeneous, mass of material that has accumulated since Buchan—a quarter of a century ago—issued his celebrated "*Challenger*" *Report on Atmospheric Circulation*. As an essential feature of this study another polar—a bi-polar—campaign is required with numerous fixed stations at work during a minimum period of $2\frac{1}{2}$ years, so as to give a complete representation of the meteorology of the Arctic and Antarctic zones. In this connection a station at the South Pole should be set up and maintained—this is merely a matter of expense, combined with improved methods of transport. Stations are also required on the islands strewn over the ocean wastes, particularly those in the southern hemisphere. The equatorial belt should be specially investigated, and research ships should be kept cruising about in areas not covered by ordinary trade routes, or having islands available on which to establish observatories. Materials for the preparation of daily maps of the whole globe would thus be ready, the study of which would pave the way for the application of the data to the elucidation of the utilitarian problems in hand. The International Arctic campaign of the years 1882-83 was restricted to the northern hemisphere, the Antarctic co-operation of 1901-1904 stopped short at the thirtieth parallel of south latitude; we require now the extension of the area of synoptic observation over the whole world.

There is no reason why the preliminaries of such a scheme should not begin at once, at least in so far as the getting of normals is concerned. There are apparently no Buchans to tackle this work single-handed, nor is this indeed desirable considering the enormous labour and delay involved in individual effort. A Bureau to deal with World-Meteorology is required, one of the first duties of which would be to prepare the homogeneous normals referred to above, and especially to discuss abnormals and to explain their causes. A good deal of trouble would accompany this preliminary work in so far as the meteorology of the ocean is involved, because there are few means available over a series of years for specific areas from which abnormals could be discussed, while large portions of the ocean are practically unrepresented by data from one year to another. For example, there is little difficulty in dealing with the monthly abnormals of a fixed land station; but if we wish to discuss the same data for, say, any given 10° ocean square, we should have—except in rare instances already specially investigated—to go to the individual

logs contained in the various Hydrographical and other offices dealing with Maritime Meteorology, and combine the whole, so as to get means for each of the months and the years of the period we wish to investigate. This appears to be the great stumbling-block in the work outlined above, but its subjugation is practically a matter of co-operation, organization and expense.

The principal bar to progress in working out the problems associated with long range weather forecasting, doubtless lies in the inadequate State support given to most Government Meteorological Services. That the Powers that be recognize their utility is not disputed, since they would not otherwise exist, but in almost every case the extensions which an enlightened Director would like to initiate are hampered and curtailed through want of funds. Research work, on which progress really depends, has been and continues to be largely subordinated to labours of a routine character, being done in what may be ironically termed "the spare time" of an office. Data arrive in shoals without cessation and most of the available resources are expended in their reduction and publication. No one will deny for a moment that invaluable and indeed, indispensable, information is not thus being gathered, and that the seeds of modern methods, incorporating much patient research, are not yielding valuable fruit. But the field of vision is too contracted, because, when such an occurrence as a great frost, heat wave, drought, rainy period, or indeed any phenomenon of an important character takes place, while we may rely on the production of a report, excellent, one might say, in many cases perfect, in its—from a geographical stand-point—local aspects, there is seldom a line as to what has taken place in regions far distant. Our horizon seems to be narrow, and we do not stop to speculate as to whether the failure of the rainy season in some portion of the sub-tropical or equatorial regions was not responsible for the unseasonable weather that manifested itself, perhaps, several months later, in some portion of the North or South Temperate Zones.

The establishment of a World Bureau seems the only way to meet the situation, and the sooner such an institution is set on foot the better. It is most desirable that knowledge, in so far as it bears on such practical and vital questions as are involved in long range forecasting, should be common property, disseminated through the agency of a responsible institution.

What would the public think if a band of speculators in grain formed a little bureau of this character for their own special benefit? One can readily picture the economic disturbance that would be associated with the cornering of, say, the world's wheat supply, based on fore-knowledge of a failure of the crops over the greater portion of the wheat belts of the globe. Doubtless for some time those taking part in operations of this nature would still be gamblers, but the dice would be heavily loaded.

In drawing to a close what many may be inclined to designate a

THAMES VALLEY RAINFALL — DECEMBER, 1913.



Symons's Meteorological Magazine.

Watershed of River Thames above Teddington, and River Lea above Feltham, Wale

Rainfall Stations reporting isohyets.

somewhat unprofitable, and in some respects even bizarre, investigation, it may be pointed out that the method of using the preceding weather in one part of the Earth as a means of arriving at a knowledge of what will subsequently take place in another part, has already had practical application. The probable intensity of the Indian Monsoon is arrived at by just such methods, which are also successfully employed in the determination of the height of the Nile flood. Hunt, in Australia, is obtaining cable information from South America and other regions, which he is making practical use of, and there is no doubt that the methods described, initiated by the genius of Hildebrandsson, are capable of wide application. In spite of the apparently fortuitous and irregular manner in which correlations between pairs of stations begin, persist and terminate, the impression gained is that there is a regularity underlying the seemingly capricious nature of the observed phenomena. In other words, the "action centres" of the globe are probably subject to a cyclical oscillation of a more or less fixed period, and the uncertainty underlying the persistence of correlation and non-correlation is due to most of the pairs of stations utilized being located not in "action centres" but in transitional zones; some, doubtless, coming at intervals under the influence of more than one pair of "action centres."

One way of clearing up the point would be to examine the data for those stations in north-western Europe for which we possess long-period records, extending in many cases over the last 150 years. If correlations, either simultaneous, or separated by an interval of time, flashed up between pairs of stations and disappeared for regular periods, then the recurring nature of the occurrence would be recognised, and a distinct advance made on the, at present, unsatisfactory and, doubtless to many, unconvincing situation.

THE WEATHER OF DECEMBER.

THE month opened with a continuation of the abnormal warmth that was so marked a feature of the past autumn. Westerly to south-westerly winds of gale force prevailed, and heavy rain fell in Scotland, Ireland and the western portions of England during the first three days of the month. On the 1st at Southampton and Ventnor, and on the 2nd at Bath, the temperature rose to 56° , and on the latter date at Exmouth 57° was recorded. On the 3rd a secondary depression appeared over Great Britain, with strong winds and gales, and snow and sleet in various northern districts. Numerous stations in Scotland, Ireland and the north-west of England, reported more than an inch, the heaviest falls on the 3rd being 2.68 in. at Greenside Mines Westmorland, 2.67 in. at Peny Gwryd in Snowdonia, and 2.13 in. at Keswick. Heavy rain also fell on the 2nd and 4th. On the 3rd and 4th snow fell in the Peak, Snowdon, Lake and Lammermuir districts, and in the west of Ireland. On the 5th, when

these Islands were under the influence of a ridge of high pressure, severe frost was experienced in Scotland, the sheltered thermometer falling to 7° at Balmoral, while on the 6th at Nairn the temperature did not rise above 23° , with maximum temperatures under the freezing point over most of the northern districts. By the morning of the 7th a large and rapid increase of temperature had set in over the north of Scotland (although locally great cold prevailed, *e.g.*, at Balmoral, minimum 5°), which became general over Great Britain on the 8th, as our islands came under the influence of a deep depression centred over Iceland. The highest temperatures were noted over Scotland, where in many places shade values exceeding 55° were noted on the 8th and 9th. As far north as Gordon Castle on the 9th the thermometer rose to 59° , and at Balmoral the temperature rose 50° in little more than 24 hours. In England lower day temperatures prevailed, the maximum however rising to 57° at Hawarden on the 8th. From about the 8th to the 16th pressure was highest to the southward of our islands, with westerly winds, high temperature and little rainfall, except in the few normally rainy localities in the north-west of Scotland, where from the 11th to the 15th daily falls exceeding an inch were measured, the maximum being 1.69 in. at Glencarron on the 15th. On the 16th the south-west of the country was covered by an anticyclone which had moved up from that direction, and temperature fell generally from its previous high level, but until almost the close of the month the general mean was in excess of the normal. On the 23rd southern England came under the influence of a depression which the day previous was located to the west of Lisbon, and temperature fell. On the 26th a rapid rise of temperature of short duration set in, which was associated with heavy rains in the north-west of Scotland and in the Lake district. The heaviest falls reported were 2.98 in. at Seathwaite on the 25th and 2.54 in. at Pen-y-Gwryd on the 26th, but in Scotland the maximum falls did not much exceed an inch. From the 27th to the 29th snow fell in many places, the depth in central and western Perthshire being six inches. The year closed with sharp frost over the greater portion of our islands, with minima as low as 4° at Hawick and 17° at Birr Castle. The general rainfall of the month expressed as a percentage of the average was : England and Wales, 64 ; Scotland, 92 ; Ireland, 82 ; British Isles, 77.

THE RAINFALL OF 1913.

THE year that has just closed was characterised in each of the three main divisions of the British Isles by a rainfall which differed but little from the average, so that the general fall for the whole country was within one per cent. of the normal. The following short Table shows that Scotland was the driest country with a deficiency of 6 per cent., in England and Wales there was a deficit of 2 per cent., while

in Ireland the excess amounted to 5 per cent., the general results showing a deficiency of 1 per cent.

General Rainfall of 1913 expressed as a percentage of the Average.

| MONTH. | England and Wales. | Scotland. | Ireland. | British Isles. |
|-----------------|-----------------------|-----------|----------|-------------------|
| January | 166 | 95 | 174 | 147 |
| February | 60 | 80 | 71 | 69 |
| March | 169 | 159 | 145 | 159 |
| April | 180 | 138 | 154 | 161 |
| May | 112 | 129 | 154 | 128 |
| June | 73 | 123 | 100 | 93 |
| July | 43 | 29 | 33 | 37 |
| August | 50 | 41 | 37 | 44 |
| September | 94 | 77 | 119 | 96 |
| October | 98 | 72 | 106 | 93 |
| November | 109 | 126 | 116 | 116 |
| December | 64 | 92 | 82 | 77 |
| Year 1913 | 98 | 94 | 105 | 99 |

July was the driest month everywhere, with little more than one-third of the average, Scotland in this month having 29 per cent., Ireland 33 per cent. and England and Wales 43 per cent. of the normal. August was also dry, England and Wales having exactly half the average fall, while Scotland and Ireland had 41 per cent. and 37 per cent. respectively. In the west of Scotland and some parts of the English Lake District the drought continued throughout September, so that in many of the normally wet localities the summer season, from the point of view of the holiday maker, was the finest on record, especially as these places, in contrast to most other districts, enjoyed more than the normal amount of sunshine. At Ambleside the combined rainfall for the third quarter of the year formed only 9 per cent. of the total for 1913, and at Rothesay in the Island of Bute, where we have a record extending back to the year 1800, the rainfall corresponding to the third quarter of the year has never been so low. Other parts of the country, however, were not so favoured and in a period of disturbed weather in September there occurred several rainstorms of great intensity, the most notable being those at Newcastle-on-Tyne, on September 16th, and at Doncaster on the day following.

The wettest month in the year, taking the country as a whole, was April with an excess of 61 per cent., and in England and Wales the excess was as much as 80 per cent. In Scotland, March was the wettest month with an excess of 59 per cent., and in Ireland the maximum occurred in January with 74 per cent. above the average. Speaking generally, January, March and April were wet months, and July and August dry months, the other months of the year not showing any marked departure from the average.

As regards the geographical distribution of the rain, the most noteworthy departures from the normal were (1) the marked deficiency,

amounting to 20 per cent, that occurred on the eastern littoral from Orkney to the Wash, and (2) the moderate excess over the greater part of Ireland, the whole of Wales, the south-west and south of England, and in a less marked degree in the central part of Scotland. The most striking feature was thus the deficiency in the east and the excess in the west of the country.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE STEVENSON SCREEN.

As the correspondents in the last three numbers of your Magazine have been discussing the accuracy of the temperatures given by thermometers in the Stevenson Screen might I be permitted to refer to some tests made of that and other screens, the results of which were communicated in four papers to the Royal Society, Edinburgh, during the years 1883-87. It is there shown that the Stevenson Screen gives too high a reading on all days when there is sunshine, and the error is greatest when the wind is light and blowing from the south, that is, from the sun heated side of the screen. The true temperature of the air for these tests was taken by means of a thermometer placed inside an enclosure through which a strong current of air was kept up by means of a fan, and special precautions were taken to prevent any heating of the enclosure radiating to the bulb. Compared with the readings given by this standard the Stevenson Screen generally read in sunshine from 1° to 3° too high. As the maximum error does not occur on all days at the time of maximum temperature it does not necessarily show in the maximum readings, yet in a series of maximum readings taken in August the error varied from $1^{\circ}6$ to $2^{\circ}6$, and an error of $2^{\circ}5$ was also observed in a calm day in November.

It is also shown that if the Stevenson Screen be closed at the bottom, so as to cut off the radiation from the grass, that the error is reduced. Dr. H. N. Dickson checked this result by observations made on Ben Nevis. He says the readings for 34 days gave a mean max. of $1^{\circ}45'$ lower in screen with closed bottom than in the one with open bottom. Further it is shown that a second top to the screen, with an open air space between the two, also tends to make the readings more correct, by preventing the heat passing through the top and affecting the thermometers. This source of error can be shown by placing one thermometer near the top and one lower down; after the screen has been exposed to an hour or two of sunshine the top one sometimes reads degrees higher than the lower. It is also

pointed out that the state of the paint on the screen has also an effect. A newly painted screen may easily be 5° lower than a dirty one.

While the Stevenson Screen frequently gives too high readings I quite agree with Mr. R. H. Curtis, in your December number, that the readings obtained by a thermometer in a N. verandah will be too low, as it will be surrounded by large objects which do not get heated to the temperature of the air, and if it is hung near a north wall it will be very much too low.

JOHN AITKEN.

WEATHER FALLACIES.

MR. R. H. CURTIS asks, *re* high temperatures in the Stevenson Screen, how the thermometer in the N. verandah was hung. It was on a wooden trellis 5 in. distant from the wall.

I am obliged to Mr. Dechevrens for his explanation of the cold S.W. and warm E. winds. My aim has been simply to record facts, not to explain them—there are too many pitfalls on that road!

ALFRED O. WALKER.

Utrcombe Place, Nr. Maidstone.

GLAZED FROST.

MAY I add a note on the remarks of Mr. Bonacina and Mr. Dines on the question of glazed frost. Both writers express their belief that supercooling does not occur and that glazed frosts are due to cold water falling upon colder solid objects; that a glazing may be produced in the way mentioned I think no one will dispute; but that fact does not *disprove* the supercooling advanced as an explanation of the occurrence of a glazed frost such as that of January 17th and 18th, 1912.

If small drops of water fall through air below the freezing point they will be cooled with great rapidity, and the difficulty appears to me to be to explain why the drops do not solidify. I have made a rough calculation (using some results of de Quervain) of the cooling of a drop 2 mm. ($\cdot 08$ in.) in diameter, and find it to be at the rate of a degree (Centigrade) for every metre of fall if the temperature of the air is 2° C. below that of the drop, neglecting the effect of evaporation, which will be to increase the rate of cooling (the drop in falling acts as a wet-bulb). Thus with an air temperature below -2° C. (29° F.) the drop would lose sufficient heat in falling through 100 m. (328 feet) to turn it to ice. With a temperature of 31° F. it would take a fall of about 300 m. (984 feet) to freeze the drop (with smaller drops the cooling would be more rapid).

The question of supercooling might be tested by measuring the temperature of the falling rain on an occasion of glazed frost by collecting it in some form of calorimeter from which the effect of the air temperature could be excluded. Or possibly Mr. Dines' experiment could be tried during a hard frost by using water at 32° F., and sending it from an upper window in order that the drops might have a long enough flight to give them a reasonable chance of freezing. If they did not freeze but produced glazing, one might take it that they were supercooled, even although the converse could not be assumed.

One question presents itself to which I can find no answer. As the drop cannot be cooled sufficiently to solidify it all before any solidification takes place, where does it begin to solidify? At the outer surface where it is cooled?

I may point out that in the glazed frost of January, 1912, the wind at the surface was easterly, and the clouds, strato-cumulus, were also moving from the east. On January 11th, 1913, when Mr. Bonacina observed solid spherules, the temperature did not fall below freezing point at Kew or at South Kensington.

E. GOLD.

OUR WINTERS.

A RECURRENCE at 5 years' interval seem to be often suggested by our winters. Apropos of the present winter, it is interesting, I think, to tabulate the Greenwich numbers of frost days (September—May) for the winters 1844, 49, 54, 59, &c. (*i.e.*, the winters *ending* in these years). Here are the figures, with relations to the average (54) :—

| | Frost days. | Relation to average. | | Frost days. | Relation to average. |
|------|----------------|-------------------------|------|----------------|-------------------------|
| 1844 | 48 | -- 6 | 1889 | 60 | + 6 |
| 1849 | 46 | — 8 | 1894 | 42 | —12 |
| 1854 | 58 | + 4 | 1899 | 42 | —12 |
| 1859 | 40 | —14 | 1904 | 45 | — 9 |
| 1864 | 50 | — 4 | 1909 | 54 | 0 |
| 1869 | 41 | —13 | | | |
| 1874 | 50 | — 4 | | average 48·8 | |
| 1879 | 85 | +31 | | (= —5·2) | |
| 1884 | 23 | —31 | | | |

Thus, a large preponderance of mild winters, only 3 of the 14 severe. Only one winter (1879) with more than 60 frost days (greatly more, indeed). The winters of 1843, 48, &c., tell a like tale; only 3 severe out of 15; 2 with more than 60 frost days. On the other hand, winters of the years ending in 0 and 5 present a very different state of things; 9 severe out of 14; only 2 under 49; average of the 14 = $63\cdot0$ (against $48\cdot8$ of the above list).

Do these facts throw any light on our present case?

It is right to say that mild winters, as above measured, are more frequent than severe ones

ALEX. B. MACDOWALL.

10, New Parade, Worthing, 26th December, 1913.

THE DONCASTER RAIN STORM.

IN connection with the great Rain Storm at Doncaster, on September 17th last, it may be of interest to you to hear as to the character of the weather on that day in other parts of the North of England. I, therefore, send you the following notes as to the conditions here.

The early morning was magnificently fine, calm and cold (min. temp. $41^{\circ}\cdot 1$ in screen). The sun shone brightly in an almost cloudless sky till about 10.30, when the max. temp. for the day, $61^{\circ}\cdot 8$, was reached. A few clouds (cumulo-stratus) appeared in the eastern horizon about 9 a.m., and slowly spread westwards before a light E. breeze, partly obscuring the sun after 10.30. These clouds gradually became absorbed as they were carried westwards, and during the whole day the sky over the north-west of the Fylde plain and over the sea off Fleetwood remained practically cloudless. There was very little sunshine here during the afternoon, the sky being lightly clouded with, however, a few blue patches. Further to the east, over the high moors on the Yorkshire boundary and beyond, the sky was quite overcast during the afternoon and evening, and after 3 p.m. slight rain was evidently falling in West Yorkshire from what appeared to be ill-defined, almost spent showers. These rapidly became further spent as they approached this station, but gave us a few drops of rain at intervals from about 4 to 7 p.m., the total yield being $\cdot 005$ in. The wind remained light from E. all day, and the air felt dry, cool and invigorating. The distance from here to Doncaster is about 73 miles.

ALBERT WILSON, F.L.S., F.R.Met.Soc.

Brana Hill, Garstang, Lancs., Dec. 10th, 1913.

THE SNOWDON GAUGE.

ON my return from abroad a few days ago, I read in *Symons's Meteorological Magazine* for July last, p. 108, Mr. Gilbert's letter saying I was wrong as to the origin of the Snowdon gauge. I am not wrong, and if he, on his return home, will refer to p. 23 mentioned he will see that Mr. Symons did not give the credit to any one, and that the gauges were erected on Snowdon "under the joint auspices of Capt. Mathew and Mr. Symons" in 1864. This was only a few months after Mr. Symons was with me, in July, 1863, when he saw and was much pleased with Mr. Rowden's gauge, which was alongside of my ordinary low rimmed 8 in. gauge.

Mr. Rowden, as I mentioned in my former letter of February, p. 52, *invented* the gauge with the vertical cylinder made by our tinsmith in Calne, and Mr. Symons during his four days stay with me in stormy weather saw that it invariably collected more than its neighbour with the ordinary low rim, and forthwith proceeded to copy it and call it *Snowdon* because there erected.

MICHAEL FOSTER WARD.

Upton Park, Slough, 22nd Dec., 1913.

RAINFALL TABLE FOR DECEMBER, 1913.

| STATION. | COUNTY. | Lat. N. | Long. W. [*E.] | Height above Sea. ft. | RAINFALL OF MONTH. | |
|--------------------------------------|------------------------------|------------|----------------------|--------------------------------|--------------------------------|--------------|
| | | | | | Aver. 1875— 1909. in. | 1913. in. |
| Camden Square..... | <i>London</i> | 51 32 | 0 8 | 111 | 2'13 | ·79 |
| Tenterden..... | <i>Kent</i> | 51 4 | *0 41 | 190 | 2'77 | 1·21 |
| Arundel (Patching)..... | <i>Sussex</i> | 50 51 | 0 27 | 130 | 2'91 | 1·84 |
| Fawley (Cadland)..... | <i>Hampshire</i> | 50 50 | 1 22 | 52 | 3'23 | 2·31 |
| Oxford (Magdalen College)..... | <i>Oxfordshire</i> | 51 45 | 1 15 | 186 | 2'06 | ·76 |
| Wellingborough (Croyland Abbey)..... | <i>Northampton</i> | 52 18 | 0 41 | 174 | 2'13 | ·85 |
| Shoeburyness..... | <i>Essex</i> | 51 31 | *0 48 | 13 | 1'71 | ·81 |
| Bury St. Edmunds (Westley)..... | <i>Suffolk</i> | 52 15 | *0 40 | 226 | 2'14 | ·90 |
| Geldeston [Beccles]..... | <i>Norfolk</i> | 52 27 | *1 31 | 38 | 2'07 | ·89 |
| Polapit Tamar [Launceston]..... | <i>Devon</i> | 50 40 | 4 22 | 315 | 4'46 | 3·88 |
| Rousdon [Lyme Regis]..... | "..... | 50 41 | 3 0 | 516 | 3'68 | 2·03 |
| Stroud (Upheld)..... | <i>Gloucestershire</i> | 51 44 | 2 13 | 226 | 2'71 | 1·25 |
| Church Stretton (Wolstaston)..... | <i>Shropshire</i> | 52 35 | 2 48 | 800 | 2'99 | 1·78 |
| Coventry (Kingswood)..... | <i>Warwickshire</i> | 52 24 | 1 30 | 340 | 2'66 | 1·14 |
| Boston..... | <i>Lincolnshire</i> | 52 58 | 0 1 | 11 | 1'88 | ·62 |
| Worksop (Hodssock Priory)..... | <i>Nottinghamshire</i> | 53 22 | 1 5 | 56 | 2'17 | 1·34 |
| Macclesfield..... | <i>Cheshire</i> | 53 15 | 2 7 | 501 | 3'35 | 2·02 |
| Southport (Hesketh Park)..... | <i>Lancashire</i> | 53 38 | 2 59 | 38 | 3'10 | 1·86 |
| Arncliffe Vicarage..... | <i>Yorkshire, W.R.</i> | 54 8 | 2 6 | 732 | 6'75 | 4·56 |
| Wetherby (Ribston Hall)..... | "..... | 53 59 | 1 24 | 130 | 2'27 | 1·67 |
| Hull (Pearson Park)..... | " <i>E.R.</i> | 53 45 | 0 20 | 6 | 2'32 | 1·56 |
| Newcastle (Town Moor)..... | <i>Northumberland</i> | 54 59 | 1 38 | 201 | 2'46 | 1·33 |
| Borrowdale (Seathwaite)..... | <i>Cumberland</i> | 54 30 | 3 10 | 423 | 15'14 | 14·07 |
| Cardiff (Ely)..... | <i>Glamorgan</i> | 51 29 | 3 13 | 53 | 4'70 | 2·35 |
| Haverfordwest..... | <i>Pembroke</i> | 51 48 | 4 58 | 90 | 5'18 | 3·31 |
| Aberystwyth (Gogerddan)..... | <i>Cardigan</i> | 52 26 | 4 1 | 83 | 4'66 | 3·21 |
| Llandudno..... | <i>Carnarvon</i> | 53 20 | 3 50 | 72 | 2'84 | 2·20 |
| Cargen [Dumtries]..... | <i>Kirkcudbright</i> | 55 2 | 3 37 | 80 | 4'84 | 3·37 |
| Marchmont House..... | <i>Berwick</i> | 55 44 | 2 24 | 498 | 2'83 | 2·45 |
| Girvan (Pinmore)..... | <i>Ayr</i> | 55 10 | 4 49 | 207 | 5'48 | 5·68 |
| Glasgow (Queen's Park)..... | <i>Renfrew</i> | 55 53 | 4 18 | 144 | 3'95 | 3·74 |
| Inveraray (Newtown)..... | <i>Argyll</i> | 56 14 | 5 4 | 17 | 8'57 | 9·11 |
| Mull (Quinish)..... | "..... | 56 34 | 6 13 | 35 | 6'59 | 4·97 |
| Dundee (Eastern Necropolis)..... | <i>Forfar</i> | 56 28 | 2 57 | 199 | 2'67 | 1·29 |
| Braemar..... | <i>Aberdeen</i> | 57 0 | 3 24 | 1114 | 3'13 | 2·22 |
| Aberdeen (Cranford)..... | "..... | 57 8 | 2 7 | 120 | 3'43 | 2·11 |
| Cawdor..... | <i>Nairn</i> | 57 31 | 3 57 | 250 | 2'53 | 2·65 |
| Fort Augustus (S. Benedict's)..... | <i>E. Inverness</i> | 57 9 | 4 41 | 68 | 5'62 | 5·81 |
| Loch Torridon (Bendamph)..... | <i>W. Ross</i> | 57 32 | 5 32 | 20 | 9'86 | ... |
| Dunrobin Castle..... | <i>Sutherland</i> | 57 59 | 3 56 | 14 | 3'09 | 4·27 |
| Wick..... | <i>Caithness</i> | 58 26 | 3 6 | 77 | 3'11 | 3·51 |
| Killarney (District Asylum)..... | <i>Kerry</i> | 52 4 | 9 31 | 178 | 6'92 | 4·62 |
| Waterford (Brook Lodge)..... | <i>Waterford</i> | 52 15 | 7 7 | 104 | 4'32 | 1·66 |
| Nenagh (Castle Lough)..... | <i>Tipperary</i> | 52 54 | 8 24 | 120 | 4'34 | 3·22 |
| Ennistymon House..... | <i>Clare</i> | 52 57 | 9 18 | 37 | 5'03 | 4·97 |
| Gorey (Courtown House)..... | <i>Wexford</i> | 52 40 | 6 13 | 80 | 3'42 | 1·46 |
| Abbey Leix (Blandsfort)..... | <i>Queen's County</i> | 52 56 | 7 17 | 532 | 3'41 | 1·64 |
| Dublin (Fitz William Square)..... | <i>Dublin</i> | 53 21 | 6 14 | 54 | 2'27 | 1·86 |
| Mullingar (Belvedere)..... | <i>Westmeath</i> | 53 29 | 7 22 | 367 | 3'39 | 3·06 |
| Crossmolina (Enniscoe)..... | <i>Mayo</i> | 54 4 | 9 16 | 74 | 6'11 | 5·53 |
| Cong (The Glebe)..... | "..... | 53 33 | 9 16 | 112 | 5'42 | 5·24 |
| Collooney (Markree Obsy.)..... | <i>Sligo</i> | 54 11 | 8 27 | 127 | 4'34 | 5·18 |
| Seaforde..... | <i>Down</i> | 54 19 | 5 50 | 180 | 3'77 | 3·15 |
| Bushmills (Dundarave)..... | <i>Antrim</i> | 55 12 | 6 30 | 162 | 3'87 | 3·81 |
| Omagh (Edenfel)..... | <i>Tyrone</i> | 54 36 | 7 18 | 280 | 3'91 | 4·47 |

RAINFALL TABLE FOR DECEMBER, 1913—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. | 1913. | Diff. from Aver. in. | % of Av. | in. | | |
| -1.34 | 37 | .27 | 23 | 8 | 25.11 | 22.41 | -2.70 | 89 | 25.11 | Camden Square |
| -1.56 | 44 | .62 | 23 | 11 | 27.64 | 26.06 | -1.58 | 94 | 27.64 | Tenterden |
| -1.07 | 63 | .88 | 23 | 11 | 30.48 | 37.47 | +6.99 | 123 | 30.48 | Patching |
| - .92 | 72 | .82 | 24 | 15 | 31.87 | 32.47 | + .60 | 102 | 31.87 | Cadland |
| -1.30 | 37 | .20 | 6 | 12 | 24.58 | 21.76 | -2.82 | 89 | 24.58 | Oxford |
| -1.28 | 40 | .35 | 4 | 11 | 25.17 | 22.29 | -2.88 | 89 | 25.17 | Croyland Abbey |
| - .90 | 47 | .33 | 23 | 12 | 19.28 | 19.73 | + .45 | 102 | 19.28 | Shoeburyness |
| -1.24 | 42 | .35 | 4 | 13 | 25.40 | 22.81 | -2.59 | 90 | 25.40 | Westley |
| -1.18 | 43 | .24 | 30 | 17 | 23.73 | 22.25 | -1.48 | 94 | 23.73 | Geldeston |
| - .58 | 87 | .75 | 23 | 19 | 38.27 | 42.57 | +4.30 | 111 | 38.27 | Polapit Tamar |
| -1.65 | 55 | .62 | 23 | 14 | 33.54 | 31.40 | -2.14 | 94 | 33.54 | Rousdon |
| -1.46 | 46 | .41 | 6 | 13 | 29.81 | 29.27 | - .54 | 98 | 29.81 | Stroud |
| -1.21 | 60 | .56 | 4 | 16 | 32.41 | 35.39 | +2.98 | 109 | 32.41 | Wolstaston |
| -1.52 | 43 | .53 | 4 | 8 | 28.98 | 25.82 | -3.16 | 89 | 28.98 | Coventry |
| -1.26 | 33 | .21 | 29 | 10 | 23.35 | 22.90 | - .45 | 98 | 23.35 | Boston |
| - .83 | 62 | .46 | 29 | 9 | 24.46 | 22.34 | -2.12 | 91 | 24.46 | Hodsock Priory |
| -1.33 | 60 | .35 | 3 | 18 | 34.73 | 30.99 | -3.74 | 89 | 34.73 | Macclesfield |
| -1.24 | 60 | .41 | 4 | 17 | 32.70 | 28.89 | -3.81 | 88 | 32.70 | Southport |
| -2.19 | 68 | 1.14 | 25 | 20 | 61.49 | 56.79 | -4.70 | 92 | 61.49 | Arneliffe |
| - .66 | 74 | ... | ... | ... | 26.87 | 22.17 | -4.70 | 83 | 26.87 | Ribston Hall |
| - .76 | 67 | .46 | 29 | 14 | 26.42 | 20.49 | -5.93 | 78 | 26.42 | Hull |
| -1.13 | 54 | .47 | 26 | 10 | 27.94 | 27.01 | - .93 | 97 | 27.94 | Newcastle |
| -1.07 | 93 | 2.98 | 25 | 21 | 129.48 | 124.07 | -5.41 | 96 | 129.48 | Seathwaite |
| -2.35 | 50 | .50 | 6 | 21 | 42.28 | 45.48 | +3.20 | 108 | 42.28 | Cardiff |
| -1.87 | 64 | .51 | 6 | 17 | 46.81 | 53.19 | +6.38 | 114 | 46.81 | Haverfordwest |
| -1.45 | 69 | .49 | 6 | 22 | 45.46 | 56.63 | +11.17 | 124 | 45.46 | Gogerddan |
| - .64 | 77 | .48 | 26 | 15 | 30.36 | 31.78 | +1.42 | 105 | 30.36 | Llandudno |
| -1.47 | 70 | 1.05 | 3 | 20 | 43.47 | 47.38 | +3.91 | 109 | 43.47 | Cargen |
| - .38 | 87 | .66 | 3 | 15 | 33.76 | 26.07 | -7.69 | 77 | 33.76 | Marchmont |
| + .20 | 104 | 1.18 | 3 | 20 | 49.77 | 46.85 | -2.92 | 94 | 49.77 | Girvan |
| - .21 | 95 | 1.18 | 3 | 18 | 35.97 | 35.24 | - .73 | 98 | 35.97 | Glasgow |
| + .54 | 106 | 1.34 | 2 | 24 | 68.67 | 72.50 | +3.83 | 106 | 68.67 | Inveraray |
| -1.62 | 75 | ... | ... | ... | 56.57 | 54.20 | -2.37 | 96 | 56.57 | Quinish |
| -1.38 | 48 | .88 | 3 | 11 | 28.64 | 23.24 | -5.40 | 81 | 28.64 | Dundee |
| - .91 | 71 | .48 | 3 | 18 | 34.93 | 30.92 | -4.01 | 89 | 34.93 | Braemar |
| -1.32 | 62 | .95 | 3 | 14 | 32.73 | 25.83 | -6.90 | 79 | 32.73 | Aberdeen |
| + .12 | 105 | .52 | 3 | 10 | 29.33 | 22.95 | -6.38 | 78 | 29.33 | Cawdor |
| + .19 | 103 | .89 | 2 | 19 | 44.53 | 45.50 | + .97 | 102 | 44.53 | Fort Augustus |
| ... | ... | ... | ... | ... | 83.93 | ... | ... | ... | 83.93 | Bendarnagh |
| +1.18 | 138 | .57 | 3 | 19 | 31.90 | 26.32 | -5.58 | 83 | 31.90 | Dunrobin Castle |
| + .40 | 113 | .48 | 3 | 21 | 29.88 | 24.48 | -5.40 | 82 | 29.88 | Wick |
| -2.30 | 67 | 1.45 | 3 | 18 | 54.81 | 58.86 | +4.05 | 107 | 54.81 | Killarney |
| -2.66 | 38 | .47 | 3 | 10 | 39.57 | 40.42 | + .85 | 102 | 39.57 | Waterford |
| -1.12 | 74 | .75 | 3 | 14 | 39.43 | 42.26 | +2.83 | 107 | 39.43 | Castle Lough |
| - .06 | 99 | 1.54 | 3 | 20 | 46.52 | 52.20 | +5.68 | 112 | 46.52 | Ennistymon |
| -1.96 | 43 | .57 | 5 | 9 | 34.99 | 33.80 | -1.19 | 97 | 34.99 | Courtown Ho. |
| -1.77 | 48 | .47 | 3 | 13 | 35.92 | 40.59 | +4.67 | 113 | 35.92 | Abbey Leix |
| - .41 | 82 | .55 | 3 | 12 | 27.68 | 28.84 | +1.16 | 104 | 27.68 | Dublin |
| - .33 | 90 | 1.02 | 3 | 17 | 36.15 | 38.18 | +2.03 | 106 | 36.15 | Mullingar |
| - .58 | 91 | 1.39 | 3 | 22 | 52.87 | 60.21 | +7.34 | 114 | 52.87 | Enniscoe |
| - .18 | 97 | .95 | 25 | 20 | 48.90 | 51.64 | +2.74 | 106 | 48.90 | Cong |
| + .84 | 119 | .77 | 3 | 21 | 42.71 | 45.64 | +2.93 | 107 | 42.71 | Markree |
| - .62 | 84 | .78 | 26 | 13 | 38.91 | 40.31 | +1.40 | 104 | 38.91 | Seaforde |
| - .06 | 98 | .57 | 4 | 21 | 37.56 | 31.76 | -5.80 | 85 | 37.56 | Dundarave |
| + .56 | 114 | .65 | 2 | 21 | 39.38 | 40.64 | +1.26 | 103 | 39.38 | Omagh |

SUPPLEMENTARY RAINFALL, DECEMBER, 1913.

| Div. | STATION. | Rain inches. | Div. | STATION. | Rain inches |
|-------|-------------------------------|-----------------|--------|-------------------------------|----------------|
| II. | Warlingham, Redvers Road.. | 1.46 | XI. | Lligwy | 2.23 |
| „ | Ramsgate | 1.26 | „ | Douglas | ... |
| „ | Hailsham | 1.99 | XII. | Stoneykirk, Ardwel House... | 3.89 |
| „ | Totland Bay, Aston House... | 1.75 | „ | Dalry, The Old Garroch..... | 7.46 |
| „ | Stockbridge, Ashley.. | 1.88 | „ | Beattock, Kinnelhead | 5.33 |
| „ | Grayshott | 1.87 | „ | Langholm, Drove Road | 2.92 |
| III. | Harrow Weald, Hill House... | .99 | XIII. | Meggat Water, Cramilt Lodge | 3.48 |
| „ | Caversham, Rectory Road ... | 1.32 | „ | North Berwick Reservoir..... | ... |
| „ | Pitsford, Sedgebrook..... | .96 | „ | Edinburgh, Royal Observatv. | 1.72 |
| „ | Woburn, Milton Bryant..... | 1.20 | XIV. | Maybole, Knockdon Farm ... | 4.38 |
| „ | Chatteris, The Priory..... | .76 | XV. | Ballachulish House | 7.02 |
| IV. | Colchester, Hill Ho., Lexden | .74 | „ | Campbeltown, Witchburn .. | 3.77 |
| „ | Newport, Belmont House ... | ... | „ | Holy Loch, Ardnadam..... | 7.60 |
| „ | Ipswich, Rookwood, Copdock | .60 | „ | Islay, Eallabus | 5.29 |
| „ | Blakeney | .51 | „ | Tiree, Cornaigmore | 4.05 |
| „ | Swaffham | .52 | XVI. | Dollar Academy | 4.04 |
| V. | Bishops Cannings | 2.01 | „ | Balquhider, Stronvar..... | 6.32 |
| „ | Winterbourne Steepleton..... | ... | „ | Glenlyon, Meggernie Castle.. | 6.18 |
| „ | Ashburton, Druid House... .. | 3.57 | „ | Blair Atholl | 1.88 |
| „ | Cullompton | 2.33 | „ | Coupar Angus | .91 |
| „ | Lynmouth, Rock House ... | 3.84 | „ | Montrose, Sunnyside Asylum. | 1.41 |
| „ | Okehampton, Oaklands..... | 5.10 | XVII. | Alford, Lynturk Manse | 2.16 |
| „ | Hartland Abbey..... | 3.09 | „ | Fyvie Castle | 3.72 |
| „ | Probus, Lamellyn..... | 3.70 | „ | Keith Station .. | 3.11 |
| „ | North Cadbury Rectory..... | 2.43 | XVIII. | Alvey Manse | ... |
| VI. | Clifton, Pembroke Road..... | 2.18 | „ | Loch Quoich, Loan | 26.90 |
| „ | Ross, The Graig | .88 | „ | Drumnadrochit | 4.41 |
| „ | Shifnal, Hatton Grange..... | 1.28 | „ | Skye, Dunvegan | 7.46 |
| „ | Droitwich..... | 1.19 | „ | N. Uist, Lochmaddy | ... |
| „ | Blockley, Upton Wold..... | 1.11 | „ | Glencarron Lodge | 12.51 |
| VII. | Market Overton..... | 1.05 | XIX. | Invershin | 2.49 |
| „ | Market Rasen | .77 | „ | Melvich | 5.80 |
| „ | Bawtry, Hesley Hall | .98 | „ | Loch Stack, Ardochullin | 12.32 |
| „ | Derby, Midland Railway..... | 1.01 | XX. | Skibbereen Rectory | 2.26 |
| „ | Buxton | 2.94 | „ | Dunmanway, The Rectory .. | 3.09 |
| VIII. | Nantwich, Dorfold Hall | 1.65 | „ | Glanmire, Lota Lodge, No. 1 | 1.82 |
| „ | Chatburn, Middlewood | 3.32 | „ | Mitchelstown Castle..... | 2.13 |
| „ | Cartmel, Flookburgh | 3.46 | „ | Darrynane Abbey..... | 3.58 |
| IX. | Langsett Moor, Up. Midhope | 3.37 | „ | Clonmel, Bruce Villa | 1.31 |
| „ | Scarborough, Scalby | 1.67 | „ | Newmarket-on-Fergus, Fenloe | 3.59 |
| „ | Ingleby Greenhow | 2.09 | XXI. | Laragh, Glendalough | 3.42 |
| „ | Mickleton | 3.10 | „ | Ballycumber, Moorock Lodge | 2.99 |
| X. | Bellingham, High Green Manor | 2.75 | „ | Balbriggan, Ardgillan | 1.95 |
| „ | Ilderton, Lilburn Cottage ... | 1.16 | XXII. | Woodlawn | 4.62 |
| „ | Keswick, The Bank..... | 5.67 | „ | Westport, St. Helens ... | 4.29 |
| XI. | Llanfrechfa Grange | 2.21 | „ | Dugort, Slievemore Hotel ... | 6.52 |
| „ | Treherbert, Tyn-y-waun | 5.90 | „ | Mohill Rectory | 4.26 |
| „ | Carmarthen, The Friary | 2.65 | XXIII. | Enniskillen, Portora..... | 3.91 |
| „ | Castle Malgwyn [Llechryd]... | 2.33 | „ | Dartrey [Cootehill] | 3.94 |
| „ | Crickhowell, Tal-y-maes | 2.70 | „ | Warrenpoint, Manor House .. | 2.63 |
| „ | New Radnor, Ednol | 2.29 | „ | Banbridge, Milntown | 2.42 |
| „ | Birmingham WW., Tynmynydd | 4.32 | „ | Belfast, Cave Hill Road | 3.82 |
| „ | Lake Vyrnwy | 3.36 | „ | Glenarm Castle..... | 5.23 |
| „ | Llangyhanfal, Plâs Draw..... | 2.85 | „ | Londonderry, Creggan Res... | 4.40 |
| „ | Dolgelly, Bryntirion..... | 4.47 | „ | Dunfanaghy, Horn Head ... | 5.42 |
| „ | Bettws-y-Coed, Tyn-y-bryn... | ... | „ | Killybegs | 7.46 |

METEOROLOGICAL NOTES ON DECEMBER, 1913.

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.—Dull or cloudy generally, but unusually dry and mild throughout. Mean temp. $41^{\circ}\cdot7$ or $2^{\circ}\cdot0$ above the average. Duration of sunshine $31\cdot7^*$ hours, and of E $23\cdot7$ hours. Evaporation $\cdot32$ in. Shade max. $55^{\circ}\cdot3$ on 9th; min. $26^{\circ}\cdot9$ on 25th. F 9, f 14.

TENTERDEN.—A dry month, but not a fine one, there being 15 sunless days. Duration of sunshine $53\cdot0^{\dagger}$ hours. Shade max. $54^{\circ}\cdot5$ on 1st; min. $26^{\circ}\cdot5$ on 29th. F 8, f 17.

TOTLAND BAY.—Duration of sunshine $61\cdot0^*$ hours or $7\cdot0$ hours above the average. The first frost in the screen this winter occurred on the 21st, which is 30 days later than usual. Mean temp. $44^{\circ}\cdot0$.

IPSWICH, COPDOCK.—A dry month with equable temp. until the last 9 days when the weather became markedly colder, and the lowest grass temp. of the year, $12^{\circ}\cdot3$, was recorded on the morning of 31st. Mean temp. $39^{\circ}\cdot9$. Shade max. $53^{\circ}\cdot2$ on 9th; min. $23^{\circ}\cdot7$ on 31st. F 13, f 16.

NORTH CADBURY.—The early part was very gloomy, but in the middle and end of the month there were some beautiful days. It was mild to 18th, cool from 19th to 27th, and cold in the last 4 days. Shade max. $54^{\circ}\cdot5$ on 9th; min. $24^{\circ}\cdot0$ on 31st. F 9, f 15.

DROITWICH.—Mild up to 18th, the shade max. exceeding 50° on 11 days; colder after 21st. A bunch of Dorothy Perkins roses and one half-opened Mad. Berard rose were picked on the 24th. Shade max. $57^{\circ}\cdot0$ on 1st; min. $21^{\circ}\cdot0$ on 31st. F 9.

HODSOCK PRIORY.—Mild and dry up to Christmas, with rather heavy S and a sharp frost at the end of the month. Shade max. $55^{\circ}\cdot5$ on 8th; min. $19^{\circ}\cdot2$ on 31st. F 11, f 17.

SOUTHPORT.—An exceptional prevalence of strong W. winds. Duration of sunshine $43\cdot1^*$ hours, and of E $45\cdot9$ hours. Mean temp. $42^{\circ}\cdot6$, or $3^{\circ}\cdot1$ above the average. Evaporation $\cdot30$ in. Shade max. $53^{\circ}\cdot0$ on 3rd and 8th; min. $22^{\circ}\cdot0$ on 31st. F 4, f 10.

LILBURN.—Dry and mild till 25th; 5 inches of S fell 28th–30th.

HAVERFORDWEST.—Very mild, with small E . Duration of sunshine $57\cdot6^*$ hours. Shade max. $63^{\circ}\cdot8$ on 9th; min. $25^{\circ}\cdot3$ on 31st. F 3.

LLANDUDNO.—Shade max. $55^{\circ}\cdot0$ on 3rd; min. $27^{\circ}\cdot0$ on 31st.

MARCHMONT.—Duration of sunshine $29\cdot1$ hours on 15 days.

TREE, CORNAIGMORE.—For 25 days the wind was westerly, and veered from S.W. to N.N.W. Often strong from W. and N.W., on 4 occasions blowing a gale.

COUPAR ANGUS.—Remarkable for unusually good weather. The E was below, and temp. much above, the average. The first week and the last few days were noteworthy for low temperature readings.

LYNTURK.— E about an inch under the average. Great scarcity of water for all purposes. Shade max. $54^{\circ}\cdot5$ on 8th; min. $2^{\circ}\cdot0$ on 30th. F 20.

DRUMNADROCHIT.— S fell to a depth of 5 inches on 27th, and an additional fall of 7 inches occurred on 28th.

LOCH STACK.—Duration of sunshine $8\cdot5^*$ hours.

WATERFORD.—The driest December since 1883. Shade max. $53^{\circ}\cdot5$ on 2nd; min. $22^{\circ}\cdot0$ on 31st. F 6.

DUBLIN.—The first half was mild and unsettled, with strong S.W. and W. winds. A dull anticyclonic period from 16th to 21st, after which it was cold except on 26th which was mild, but wet and stormy. Shade max. $56^{\circ}\cdot8$ on 8th; min. $25^{\circ}\cdot6$ on 31st. F 3, f 9.

WARRENPOINT.—The first half was mild, but in the latter half there was S , sleet and low temp. Shade max. $55^{\circ}\cdot0$ on 8th; min. $21^{\circ}\cdot0$ on 30th. F 8, f 13.

OMAGH.—Exceptionally mild to the last 3 days when hard frost set in.

* Campbell-Stokes.

† Jordan.

Climatological Table for the British Empire, July, 1913.

| STATIONS. (Those in italics are South of the Equator.) | Absolute. | | | | Average. | | | | Absolute. | | Total Rain | | Aver. Cloud. |
|--|-----------|-------|----------|-------|----------|------|---------------|-----------|-----------------|-------------------|------------|-------|-----------------|
| | Maximum. | | Minimum. | | Max. | Min. | Dew Point. | Humidity. | Max. in Sun. | Min. on Grass. | Depth. | Days. | |
| | Temp. | Date. | Temp. | Date. | | | | | | | | | |
| | | | | | | | | | | | | | |
| London, Camden Square | 78°9 | 28 | 44°3 | 8 | 70°2 | 52°5 | 52°8 | 80 | 124°7 | 43°2 | 2·31 | 12 | 8·8 |
| Malta | 88·0 | 31 | 62·3 | 6 | 80·7 | 68·8 | ... | 69 | 146·0 | .. | ·00 | 0 | 2·4 |
| Lagos | 87·2 | 27 | 71·0 | 19 | 83·7 | 73·7 | 73·4 | 84 | 155·4 | 69·0 | 15·57 | 21 | 7·9 |
| Cape Town | 68·3 | 18 | 36·3 | 9 | 60·3 | 46·2 | 48·1 | 82 | ... | ... | 4·01 | 16 | 6·4 |
| Natal, Durban | 70·0 | 4, 29 | 48·0 | 17 | 64·4 | 54·3 | 50·0 | 71 | ... | ... | 1·86 | 2 | 3·0 |
| Johannesburg | 72·7 | 29 | 31·2 | 15 | 63·5 | 44·2 | 41·8 | 70 | 122·2 | 29·5 | ·14 | 1 | 1·9 |
| Mauritius | 75·7 | 17 | 53·1 | 26 | 73·8 | 58·9 | 57·5 | 75 | 136·5 | 46·0 | ·85 | 17 | 4·7 |
| Bloemfontein | 72·0 | 31 | 24·7 | 10 | 62·2 | 32·1 | 27·3 | 59 | ... | ... | ·01 | 1 | ... |
| Calcutta... .. | 94·5 | 11 | 75·8 | 4 | 88·2 | 79·3 | 77·9 | 86 | ... | 73·8 | 14·48 | 18 | 8·8 |
| Bombay... .. | 87·4 | 2 | 73·9 | 6 | 84·6 | 74·5 | 77·0 | 86 | 133·0 | 71·6 | 33·58 | 30 | 8·0 |
| Madras | 103·0 | 29 | 70·8 | 4 | 95·9 | 79·1 | 71·9 | 68 | 145·1 | 70·7 | 3·11 | 11 | 6·8 |
| Colombo, Ceylon | 86·5 | 6 | 70·8 | 3 | 84·5 | 76·4 | 73·9 | 80 | 150·9 | 69·8 | 7·11 | 16 | 7·9 |
| Hongkong | 92·0 | 20 | 75·3 | 31 | 88·1 | 78·8 | 76·9 | 82 | ... | ... | 15·05 | 20 | 6·7 |
| Sydney | 69·2 | 31 | 42·8 | 11 | 60·4 | 47·4 | 43·7 | 75 | 113·0 | 29·2 | 7·75 | 8 | 5·0 |
| Melbourne | 63·2 | 13 | 32·8 | 25 | 56·7 | 44·3 | 42·1 | 72 | 105·2 | 25·1 | ·70 | 16 | 6·2 |
| Adelaide | 69·6 | 13 | 34·8 | 5 | 60·6 | 44·8 | 42·9 | 71 | 127·3 | 24·7 | ·74 | 10 | 5·8 |
| Perth | 69·0 | 22 | 37·0 | 18* | 62·8 | 46·9 | 45·8 | 71 | 132·9 | 31·9 | 6·98 | 19 | 4·9 |
| Coolgardie | 70·4 | 6 | 32·0 | 19 | 61·9 | 41·6 | 38·7 | 56 | 129·0 | 26·0 | ·74 | 7 | 3·4 |
| Hobart, Tasmania | 64·0 | 15 | 30·0 | 22 | 54·2 | 40·9 | 38·6 | 67 | 106·0 | 24·2 | 1·49 | 19 | 5·4 |
| Wellington | 61·6 | 29 | 34·4 | 13 | 55·0 | 44·4 | 42·5 | 77 | 106·4 | 24·0 | 3·15 | 21 | 6·5 |
| Auckland | 62·0 | 4 | 38·5 | 25 | 56·7 | 46·8 | 45·9 | 81 | 119·0 | 35·0 | 4·37 | 25 | 7·2 |
| Jamaica, Kingston | 92·9 | 24 | 68·1 | 4 | 89·7 | 72·3 | 69·7 | 74 | ... | ... | ·92 | 4 | 4·6 |
| Grenada | 87·0 | 9 | 73·0 | 3 | 84·4 | 79·4 | ... | 75 | 139·0 | ... | 4·23 | 21 | 4·0 |
| Toronto | 95·0 | 1 | 50·0 | 26 | 82·0 | 59·0 | 55·0 | 62 | ... | ... | 2·67 | 6 | 3·4 |
| Fredericton | 91·0 | 4 | 47·0 | 17† | 76·0 | 55·0 | ... | 77 | ... | ... | 5·11 | 14 | 6·2 |
| St. John, N.B. | 80·0 | 30 | 52·0 | 1 | 67·0 | 55·0 | 55·0 | 82 | ... | ... | 3·55 | 13 | 5·5 |
| Edmonton, Alberta | 87·0 | 24 | 41·2 | 12 | 71·0 | 49·6 | ... | 67 | 138·9 | 35·8 | 5·15 | 17 | 4·6 |
| Victoria, B.C. | 85·0 | 20 | 45·0 | 29 | 72·0 | 52·0 | 51·0 | 70 | ... | ... | ·45 | 6 | 3·7 |
| Malta.....May... | 82·4 | 19 | 53·0 | 4 | 71·1 | 59·9 | ... | 77 | 139·0 | ... | ·81 | 5 | 4·0 |
|June.. | 82·2 | 21 | 63·5 | 27 | 76·3 | 65·9 | ... | 73 | 137·8 | ... | ·00 | 0 | 2·0 |

* and 19. † and 31.

Johannesburg.—Bright sunshine 299·3 hours.

Mauritius.—Mean temp. 1°·9, dew point 2°·2, and R 1·79 in., below averages. Mean hourly velocity of wind 11·1, or 0·9 below average.

COLOMBO.—Mean temp. of air 80°·5, or 0°·5 below, of dew point 0°·2 below, and R 1·38 in. above, averages. Max. velocity of wind 42 miles per hour. TSS on 2 days.

HONGKONG.—Mean temp. of air 82°·8. Mean hourly velocity of wind 9·3 miles. Bright sunshine 233·8 hours.

Melbourne.—Mean temp. of air 2°·1 above, and R 1·16 in. below, averages.

Adelaide.—Mean temp. of air 1°·2 above, and R 1·92 in. below, averages, only two drier Julys in last 74 years.

Perth.—Temp. of air 1°·1 below average.

Coolgardie.—Temp. of air 1°·0 above, and R slightly below, averages.

Hobart.—Mean temp. of air 2°·3 above, and R ·61 in. below, averages.

Wellington.—Mean temp. of air 2°·3 above, and R 2·69 in. below, averages. Bright sunshine 108·0 hours.

Auckland.—Mean temp. of air and R slightly below averages.