

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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## THE RECENT FROST.

SEVERAL correspondents have kindly sent us lists of temperatures during the cold weather at the end of December, 1892, and in the early part of January, 1893, but we do not see that the extremes are sufficiently important to claim publication, and as very few of the tables cover the whole of the cold period, we cannot quote comparable means.

We can therefore offer only some fragmentary notes :—

First, as to the absolute minima. Some of the lowest records ever made in the British Isles have been from stations near the Cheviots and between there and Edinburgh—and that seems to hold good in the recent frost. Mr. Selby, of Pawston, in the extreme N. of Northumberland, reports the minimum of  $3^{\circ}$  in the night between January 5th and 6th, and adds that at Shawdon, near Whittingham, about 20 miles S.E. of Pawston, on the same night it fell to  $-2^{\circ}$ ; but he says nothing as to the quality of the thermometer at Shawdon, or where it was placed.

Another low record, and this time from verified instruments, is sent by the Rev. G. T. Ryves from Tean Vicarage, in the valley of the Tean, above Uttoxeter, in N. Staffordshire; he had  $4^{\circ}\cdot4$  in Stevenson's screen and  $-0^{\circ}\cdot6$  on grass.

We have seen no other trustworthy records below  $5^{\circ}$ , except in the following, which we reprint from the *York Herald* of January 7th :—

“INTENSE COLD ON DEESIDE.—A telegram from Braemar states that the frost of yesterday morning was the most intense experienced on upper Deeside for the last thirty-three years. The record at Braemar Observatory was 9 degrees below zero on the grass, or 41 Fahrenheit degrees of frost. The shade thermometer recorded four below zero. These readings have not been exceeded since 1860, when the mercury fell to eleven below zero, and the nearest parallel occurred in December, 1882, when seven below zero, or thirty-nine degrees of frost, were registered.”

Not one of our own correspondents has given emphasis to his figures by any such comparison with previous years as is given above for Braemar, and our impression is that when (at the end of the month) we receive the report direct from Mr. Aitken, the above will not be confirmed. Translated into meteorological language, the above statement probably is—

1893, Jan. Min. in air,  $-4^{\circ}\cdot 0$  ; on grass,  $-9^{\circ}\cdot 0$   
but in 1882, Dec. „ „  $-8^{\circ}\cdot 0$

Therefore the recent is *not* the most intense for 33 years.

Certainly, as far as London is concerned, several more intense frosts have occurred even within comparatively recent periods. The lowest at Camden Square was  $15^{\circ}\cdot 4$  on the 5th, but as recently as 1890 we had  $15^{\circ}\cdot 6$  in *March*, and  $14^{\circ}\cdot 9$  in December; in 1887 we had the shade minimum down to  $14^{\circ}\cdot 5$ ; and to go farther back, both in 1860 and in 1867 we had a minimum of  $6^{\circ}\cdot 7$ .

The absolute shade minima at Camden Square on the original Glaisher stand have been as under :—

| Year. | Min. | Year. | Min. | Year. | Min. | Year. | Min.   |
|-------|------|-------|------|-------|------|-------|--------|
|       | deg. |       | deg. |       | deg. |       | deg.   |
| 1859  | 14·4 |       |      |       |      |       |        |
| 1860  | 6·7  | 1870  | 14·0 | 1880  | 19·2 | 1890  | 14·9   |
| 1861  | 14·3 | 1871  | 19·7 | 1881  | 11·8 | 1891  | 16·8   |
| 1862  | 18·1 | 1872  | 26·1 | 1882  | 24·5 | 1892  | 16·7   |
| 1863  | 24·5 | 1873  | 22·9 | 1883  | 22·4 | 1893  | 15·4 ? |
| 1864  | 15·1 | 1874  | 18·4 | 1884  | 25·3 |       |        |
| 1865  | 15·4 | 1875  | 20·7 | 1885  | 22·3 |       |        |
| 1866  | 22·5 | 1876  | 18·9 | 1886  | 19·4 |       |        |
| 1867  | 6·7  | 1877  | 23·5 | 1887  | 14·5 |       |        |
| 1868  | 23·4 | 1878  | 18·7 | 1888  | 19·1 |       |        |
| 1869  | 20·8 | 1879  | 16·1 | 1889  | 19·2 |       |        |

It is, of course, very unsafe to generalize from a table of extremes, but as the average for the 34 years is  $18^{\circ}\cdot 4$ , whereas for the last eight years it has been only  $17^{\circ}$ , it may be as well to point out that for the first eight years it was only  $16^{\circ}\cdot 4$ , and for the first nine only  $15^{\circ}\cdot 3$ . Again, for the first seventeen years the average was  $17^{\circ}\cdot 9$ ; for the second seventeen years  $19^{\circ}\cdot 0$ . There is, therefore, evidence both for and against an increasing tendency towards low winter temperatures, and the question is far too important for any opinion to be founded upon such slight information as this table affords.

It is probable that so cold a fortnight rarely occurs; the mean at 9 a.m. for the two weeks, December 24th to 31st and January 1st to 7th, was respectively  $26^{\circ}\cdot 4$  and  $24^{\circ}\cdot 6$ , or for the fortnight  $25^{\circ}\cdot 5$ ; this is  $0^{\circ}\cdot 7$  colder than the coldest which we can remember, viz., December 12th to 25th, 1890, but there may be others which we have forgotten.

# FROST FIGURES.

ALL who have studied the forms of snow crystals, or of the formation of ice on clean, calm and free water surfaces, are aware that the crystals are always *straight*, and join one another at an angle of 60°. Under some conditions this rule does not hold good, and beautiful *curved* designs are produced. Extremely graceful curves of this kind were abundant upon the smooth paving stones of London on the morning of December 4th, and attracted the attention of Prof. Meldola, F.R.S., who sketched some of them and sent a description of them to *Nature*. He very appropriately described the patterns as "arborescent tracery," and said that some of the "fronds" were nearly two feet long, and many were most gracefully curved. He added that "the flagstones had evidently been coated with a thin layer of mud from the previous night's rain," and that he attributed the pattern "to the rapid freezing and evaporation of the water in this surface layer of mud which was going on during the morning."

This letter was followed in *Nature* of December 15th by numerous notes as to similar appearances elsewhere, and by a few remarks which may be regarded as explanatory—three of these we reprint:—

"The interesting 'fronds' of muddy ice observed by Prof. Meldola are not very uncommon on the pavements in these 'Northern Heights.' I saw them on the date which he named, and have more than once studied them. I then noticed that the 'interstitial' pavement seemed partly cleared of mud, as if the water had drawn this towards the groups of crystals. The mode of formation recalled to my mind certain phenomena in crystal building within rocks, and I suspect the mud has its influence. Indeed, it seems to me very probable that all these 'dendritic' growths of crystals are the results of 'impeded' or 'constrained' crystallization, to some of which I have called attention in noticing a structure in the Charnwood syenite (*Quart. Jour. Geol. Soc.*, 1891, p. 101). On this point Prof. Sollas makes some important remarks in his well-known paper on the Wicklow granites."

T. G. BONNEY.

"The beautiful curved forms assumed by the ice on the paving flags last Sunday were very noticeable in this neighbourhood and Hampstead as well as in other parts of London. What I observed were not quite like those described and figured by Prof. Meldola, but resembled rather the scrolls and volutes which are frequently used in decorative art. The finest piece that I saw was in this square, where several of these scrolls radiated from a central point and spread over several feet of the pavement. A friend, Mr. E. Swain, observed that where one of these scrolls came upon a puddle of clear water, the crystals were continued in a straight line. Such forms are not at all unusual in the freezing of muddy water, and at the present moment the puddles in the road opposite my house are filled with rectilinear crystals of ice, which assume a curved form in the mud at their margins. The peculiarity on Sunday was their large size and beauty."

J. H. GLADSTONE.

17, Pembridge-square, December 10th.

"Prof. Meldola's letter has been interesting to me, as I noticed a striking and similar phenomenon here on Thursday, December 8th, in the forenoon. The trottoirs of several streets (east, west, north and south) were covered all over with beautiful patterns, somewhat different from Prof. Meldola's illustration, there being innumerable dark, broad, sharply contoured leaf-like patches, distant several inches from each other, and connected by finely curved and branched tendril-like stalks. Foggy, with a faint north breeze. I should presume the 'leaves' were due to sparse drops of sleet fallen during the night."

Freiburg, Badenia, December 10th.

D. WETTERHAN.

A fortnight later *Nature* contained some other notes.

Admiral Maclear sent a copy of an exquisite design traced from a muddy flagstone at Guildford.

Prof. Lebour referred to the illustrations of these curved crystals given in the article "Meteorology," contributed (in 1834) to the *Encyclopædia Metropolitana* by G. Harvey, F.R.S., but he does not mention (what Harvey does) that Giacinto Carena, in 1813, sent a memoir to the Academy of Turin, "Sur le givre figuré dont se couvrent les vitres pendant les fortes gelées," in which the causes of curved crystallization are pointed out.

## REVIEW.

*Observations on Dew and Frost*, by the Hon. R. RUSSELL, F.R. Met. Soc.

London: Stanford, 1892. 8vo, 47 pp.

THIS work consists of the record of a rather elaborate series of observations made on about 75 nights between June, 1891, and August, 1892, of the dew and hoar frost deposited on various vessels—pans, trays, plates, tumblers, &c.—of china, glass, and metal, placed in varying relation to the soil and atmosphere, and over and upon different kinds of soil. The deposition upon the surrounding vegetation and upon the innumerable materials which go to make up a country landscape were also carefully noted. Accurate quantitative measurements were apparently not aimed at, and were probably not possible with the apparatus used; but much attention was devoted to the deposition of dew on the inside of vessels so sunk in the soil as to prevent the circulation of air into their interiors—a point which Wells did not enlarge upon, though he clearly recognised the emanation of moisture, or moisture-laden air, from the earth.

The author refers to the effect (in displacing air from the ground) of recently fallen rain as it soaks in, and this is a point which we do not remember to have seen mentioned before. In fact, it has always appeared to us that in all observations on dew far too little attention has been paid to the temperature and humidity of the soil, the rise or fall of subsoil water, &c., in short, to all the conditions which control the passage of air into and out of the soil.

The results are summed up in ten pages, and the author states that—"In nearly all the conclusions of Wells, as stated in his admirable *Essay on Dew*, my observations lead me to concur." No

reference is made to the more recent work of Aitken on the same subject, whose results are by some considered subversive of Wells's theories.

### UNUSUAL SNOW CRYSTALS.

*To the Editor of the Meteorological Magazine.*

SIR,—Shortly after 11 a.m. this morning, when the shade temperature was about  $25^{\circ}$ , snow was falling slightly, chiefly in single crystals, but interspersed with flakes consisting of groups of crystals of any number up to ten or a dozen, but few exceeded that number. The crystals were nearly all perfect, and even in the larger flakes it was exceptional to find any debris or single spicula; and, of course, at a temp. of  $25^{\circ}$ , it was easy to examine them at one's leisure. The crystals were almost entirely of two sizes, about one-eighth inch and one-sixteenth inch in diameter, the larger being perhaps twice as numerous as the smaller. The first point which attracted my attention was that in about one-fourth of the specimens examined (not fewer than 50) a small crystal was attached to the end of one of the spiculæ of a larger one, not at right angles, but in the same plane. Whether the smaller crystals had all formed on the larger ones and become detached in falling, it is, of course, impossible to say.

About a couple of minutes before the cessation of the fall, I observed one crystal of a form which I have no recollection of having seen described. Instead of being a flat object with six points all in the same plane, the points radiated in all directions, preserving the regular angle of crystallization of water. I regret that I omitted to count the number of rays, but from models subsequently constructed, believe that it was 14. The diameter did not exceed two-tenths of an inch, but was larger than that of the crystals, above described as about one-eighth of an inch. The crystal was received on a dark cloth sleeve, where it could be well seen, and was examined carefully and for a considerable time by myself and by another witness. Although I endeavoured to catch on my arm or umbrella all promising looking specimens, I did not succeed in finding another of this form.

*Highgate, January 1st, 1893.*

H. SOWERBY WALLIS.

P.S.—On January 3rd my wife and sister observed several snow crystals of the above-described form.

[We have never seen or heard of any description of other than flat snow crystals—but it seems almost more reasonable to consider the form of ball more probable than that of disc—why then have they never been engraved or described? In Mr. Glaisher's beautiful series of engravings, there is nothing like such a figure, the only departure from the flat disc is a case of two discs united by a crystal perpendicular to the centre of each—i.e., the two crystals may be represented by the two wheels of a gig, and the single uniting crystal by the axle—but this is a very long way from a system of radii starting at angles of  $60^{\circ}$  from a common centre, and in various planes, so that the extremities form a sort of spiky ball.—*Ed.*]

## ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday evening, December 21st, at the Institution of Civil Engineers, 25, Great George-street, Westminster. Dr. C. Theodore Williams, President, in the chair.

Dr. R. H. Beardsley, Dr. T. C. Beatty, Dr. R. Brocklesby, Mr. C. H. Cotton, Dr. P. Fraser, and Dr. G. H. Ward-Humphreys, were elected Fellows of the Society.

The following papers were read :—

(1.) "Moving Anticyclones in the Southern Hemisphere," by Mr. H. C. Russell, F.R.S., Government Astronomer New South Wales. The author describes the results of his practical study of the daily weather charts for Australasia, and states that the leading fact brought out, is that the weather south of  $20^{\circ}$  S. latitude, is the product of a series of rapidly moving anticyclones, which follow one another with remarkable regularity, and are the great controlling force in determining local weather. These anticyclones are more numerous in summer than in winter; the average number for the year being 42. They usually take 7 or 8 days to travel across Australia in summer, and 9 or 10 days in winter; the average daily rate of translation being 400 miles. The shape of the anticyclone over the comparatively flat lands of Australia is an ellipse with axes in ratio of 2 to 1, the longer axis being east and west. The shape is, as a rule, modified when the anticyclone reaches the east coast range of mountains, the result being a shortening of the major axis, and a bending of it towards north and south. The winds on the north side of the anticyclone are not so strong as those on the south side, and the intensity of the weather is in proportion to the difference in pressure between the anticyclone and the V-depression, but the relation of the pressure varies frequently before the wind responds, the pressure appearing to be controlled from above by the more or less rapid descent of air which feeds the anticyclone. Cyclonic storms are very unusual, and do not occur more than once in two or three months.

The author having found that the average daily translation of anticyclones over Australia eastwards is 400 miles, endeavoured to ascertain if they maintained the same velocity over the ocean, and from a study of the Natal observations, obtains an average period of 15 days for the translation of the waves from Natal to Sydney, or a velocity of 458 miles per day.

The two determinations of velocity, that is over Australia alone where it is 400 miles per day, and over the space from Natal to Sydney where it is 458 miles per day, seem to leave no doubt as to their persistence. For if they can thus be followed one-third of the circumference of the earth, *i.e.* from Natal to Sydney, it may safely be assumed that they travel the other two-thirds of the way, and that they keep up their general characteristics.

(2.) "The Tracks of Ocean Wind Systems in transit over Australasia," by Capt. M. W. C. Hepworth, F.R.Met.Soc. The author has examined the daily weather charts of Australia and New Zealand, and has prepared maps showing the daily positions of the centres of high and low pressures for a whole year. He finds that the wind systems, which make their first appearance to the westward and south-westward, advance to the eastward rapidly, and frequently very rapidly, during the winter months; but during the summer months they usually move more slowly and not unfrequently recurve. Their progress is retarded by contact with the areas of high pressure which they encounter; the mean of the tracks of these anticyclones, moving also from west to east, appears to be across the southern portion of Australia and onward, crossing the islands of New Zealand, during the winter months; but to the southward of Western and South Australia, across Victoria and New South Wales, and thence to the north-eastward, avoiding New Zealand, during the summer months.

This paper being on a similar subject to Mr. Russell's, the two were discussed together, the speakers being—Mr. Scott, Mr. C. Harding, Rev. Clement Ley, Mr. Harries, Mr. Laughton, Mr. Strachan, Captain Wilson Barker and Mr. Symons. Several speakers commented on the paucity of observations in central Australia, and it appeared to be the general opinion that that portion of Mr. Russell's paper which dealt with the passage of anticyclones over the ocean was based on insufficient data.

(3.) "Rainfall of Nottinghamshire, 1861-90," by Mr. H. Mellish, F.R.Met.Soc. The author has collected and discussed all the recent rainfall records in or near the county extending over 10 or more years. The mean annual fall is given for 65 stations, and varies from about 30 in. on the borders of Derbyshire in the S.W., to about 23 in. in the N.E. The wettest year was 1872, with a mean for the whole county of 142 per cent., and the driest, 1887, with 68 per cent. of the average. Dividing the 30 years into three decades, the means are respectively 90 per cent., 109 per cent., and 101 per cent. of the average. The mean monthly rainfall for the 30 years, varies from 2.74 in. in October to 1.64 in. in February, the latter result being in part due to the shortness of that month. Mr. Symons called attention to the fact that the records were to a slight extent affected by the height of the gauges above ground. Mr. Southall, Mr. Wallis, Mr. Tripp and Mr. Marriott took part in the discussion.

(4.) "A new Instrument for Cloud Measurements," by Dr. Nils Ekholm, Hon. Mem. R.Met.Soc. The instrument is practically a modified equatorial telescope, and the paper gives full details of the methods of observation. The Rev. Clement Ley spoke enthusiastically of Dr. Ekholm's valuable work in connection with cloud observation.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1892.

| STATIONS.<br><br>(Those in <i>italics</i> 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         | °         | °               | inches            |             |       |       |
| England, London .....   | 82·7      | 10    | 38·6     | 15    | 69·6     | 49·6 | 47·9          | 70        | 129·6           | 31·9              | 2·46        | 13    | 5·0   |
| Malta.....  | 91·8      | 25    | 60·1     | 4     | 82·4     | 65·7 | 62·4          | 70        | 147·1           | 54·8              | ·01         | 1     | 7·9   |
| <i>Cape of Good Hope</i> ...  | 69·9      | 19    | 38·0     | 13    | 61·5     | 49·6 | ...           | ...       | ...             | ...               | 11·41       | 21    | 6·0   |
| <i>Mauritius</i> .....  | 78·7      | 16    | 64·5     | 19    | 76·6     | 67·9 | 62·1          | 72        | 122·9           | 53·0              | 4·02        | 22    | 5·7   |
| Calcutta.....   | 95·1      | 2     | 72·9     | 25    | 90·4     | 78·3 | 78·8          | 83        | 160·3           | 73·7              | 8·59        | 10    | 6·9   |
| Bombay .....  | 90·9      | 1     | 76·4     | 9     | 86·3     | 78·9 | 77·2          | 83        | 142·7           | 72·6              | 13·30       | 25    | 6·8   |
| Ceylon, Colombo .....   | 87·7      | 29    | 76·4     | 25    | 86·0     | 77·4 | 73·5          | 80        | 150·0           | 70·0              | 6·62        | 26    | 6·8   |
| <i>Melbourne</i> .....  | 63·6      | 7     | 34·6     | 14    | 56·8     | 45·8 | 44·7          | 79        | 113·4           | 30·5              | 1·29        | 13    | 7·6   |
| <i>Adelaide</i> .....   | 66·6      | 6     | 39·9     | 24    | 59·2     | 46·2 | 45·5          | 78        | 128·8           | 29·5              | 2·30        | 16    | 6·3   |
| <i>Tasmania, Hobart</i> .....   | ...       | ...   | ...      | ...   | ...      | ...  | ...           | ...       | ...             | ...               | ...         | ...   | ...   |
| <i>Wellington</i> .....   | 58·5      | 11    | 35·5     | 17    | 55·1     | 45·1 | 42·9          | 77        | 105·0           | 30·0              | 5·95        | 24    | 5·3   |
| <i>Auckland</i> .....   | 65·0      | 11    | 39·5     | 17    | 59·2     | 49·2 | 49·6          | 84        | 114·0           | 31·0              | 5·05        | 21    | 6·2   |
| Jamaica, Kingston.....  | 91·5      | 30    | 70·2     | 22    | 87·0     | 73·5 | 70·8          | 72        | ...             | ...               | 3·23        | 10    | ...   |
| Trinidad .....  | 90·0      | 22    | 68·5     | 26    | 86·0     | 70·0 | 72·3          | 84        | 154·0           | 57·0              | 16·26       | 28    | ...   |
| Toronto .....   | 85·9      | 12a   | 48·1     | 11    | 74·2     | 56·7 | 58·1          | 78        | ...             | 41·2              | 5·81        | 18    | 6·3   |
| New Brunswick,<br>Fredericton .....                                     | 85·5      | 2     | 35·5     | 10    | 71·0     | 48·3 | 52·1          | 69        | ...             | ...               | 5·71        | 24    | 5·7   |
| Manitoba, Winnipeg ...  | 83·0      | 11    | 37·5     | 16b   | 72·1     | 48·9 | ...           | ...       | ...             | ...               | 5·03        | 10    | 4·9   |
| British Columbia,<br>Esquimalt .....                                    | 74·0      | 28    | 42·5     | 9     | 63·8     | 48·6 | 50·2          | 82        | ...             | ...               | ·60         | 11    | 4·6   |

a And 16. b And 30.

## REMARKS.

MALTA.—Mean temp. 72°·7. Mean hourly velocity of wind 8·2 miles. The temp. of the sea rose from 72°·0 to 77°·0. Lightning on the 15th. J. SCOLES.

*Mauritius*.—Mean temp. of air 1°·7 above, of dew point 1°·4 above and rainfall 1·98 in. above, their respective averages. Mean hourly velocity of wind 13·8 miles, or 2·5 above average; extremes 27°·0 on 27th and 1·9 on 20th; prevailing direction, E S.E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 5 days and Lightning only was seen on one day. J. C. H. CLARKE, Lt.-Col. R.E.

*Melbourne*.—Mean temp of air 1°·5, of dew point 1°·1, and amount of cloud 1·0 above their respective averages. Mean humidity 1 and rainfall ·68 in. below their averages. Prevailing winds N. and W., strong on 9 days. Thunderstorms with heavy squalls, rain and hail on 22nd and 23rd. Heavy dew on 6 days. Hoar frost on 14th. R. L. J. ELLERY, F.R.S.

*Adelaide*.—Mean temp. 52°·7, or 0°·9 below the average of 27 years. Rainfall ·49 in. below the 35 years' average. Cloud about the average. C. TODD, F.R.S.

*Wellington*.—The first few days were fine, but the remainder of the month was very showery and unpleasant with strong winds. Hail on 11th, 14th and 15th, and light snow on the last date. Fog on 25th. Mean temp. 1°·1, and rainfall ·82 in., above the average. R. B. GORE.

*Auckland*.—A showery unsettled month, but with no heavy falls of rain, or severe storms. Rainfall very slightly above the average. Mean temp. and pressure both considerably above the average. T. F. CHEESEMAN.

TORONTO.—On the 19th 2·42 in. of rain fell, and of this 1·45 in. fell in 25 minutes.

C. CARPMAEL.



SUPPLEMENTARY TABLE OF RAINFALL,  
DECEMBER, 1892.

[For the Counties, Latitudes, and Longitudes of most of these Stations,  
see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

| Div.  | STATION.                  | Total<br>Rain. | Div.   | STATION.                   | Total<br>Rain. |
|-------|---------------------------|----------------|--------|----------------------------|----------------|
|       |                           | in.            |        |                            | in.            |
| II.   | Dorking, Abinger Hall     | 2·07           | XI.    | Rhayader, Nantgwillt..     | 3·88           |
| „     | Birchington, Thor .....   | 2·15           | „      | Corwen, Rhug .....         | 1·78           |
| „     | Brighton, Prestonville Rd | 2·62           | „      | Carnarvon, Cocksidia ...   | 2·75           |
| „     | Hailsham .....            | 2·52           | „      | I. of Man, Douglas .....   | 4·23           |
| „     | Ryde, Thornbrough .....   | 2·43           | XII.   | Stoneykirk, Ardwell Ho.    | 3·42           |
| „     | Alton, Ashdell .....      | 1·90           | „      | New Galloway, Glenlee      | 2·89           |
| III.  | Oxford, Magdalen Col...   | ·89            | „      | Melrose, Abbey Gate ...    | 1·52           |
| „     | Banbury, Bloxham .....    | 1·17           | XIII.  | N. Esk Res. [Penicuik]     | 1·85           |
| „     | Northampton, Sedgbrook    | 1·53           | „      | Edinburgh, Blacket Pl..    | 1·36           |
| „     | Cambridge, Fulbourne..    | ..             | XIV.   | Glasgow, Queen's Park.     | 1·67           |
| „     | Wisbech, Bank House..     | ·96            | XV.    | Islay, Gruinart School..   | 5·34           |
| IV.   | Southend .....            | 1·17           | XVI.   | Dollar .....               | 1·53           |
| „     | Harlow, Sheering .....    | 1·63           | „      | Balquhider, Stronvar..     | 3·22           |
| „     | Rendlesham Hall .....     | 1·41           | „      | Coupar Angus Station..     | ·93            |
| „     | Diss .....                | 1·19           | „      | Dunkeld, Inver Braan..     | ·97            |
| „     | Swaffham .....            | 1·35           | „      | Dalnaspidal H.R.S. ....    | 3·78           |
| V.    | Salisbury, Alderbury...   | ·96            | XVII.  | Keith H.R.S. ....          | ·98            |
| „     | Bishop's Cannings .....   | 1·47           | „      | Forres H.R.S. ....         | 1·34           |
| „     | Blandford, Whatcombe ..   | 1·67           | XVIII. | Fearn, Lower Pitkerrie.    | 1·40           |
| „     | Ashburton, Holne Vic...   | 3·08           | „      | Loch Shiel, Glenaladale    | 8·06           |
| „     | Okehampton, Oaklands.     | 3·29           | „      | N. Uist, Loch Maddy ...    | 3·70           |
| „     | Hartland Abbey .....      | 3·41           | „      | Invergarry .....           | 3·36           |
| „     | Lynmouth, Glenthorne.     | 2·77           | „      | Aviemore H.R.S. ....       | 2·34           |
| „     | Probus, Lamellyn .....    | 2·61           | „      | Loch Ness, Drumnadrochit   | 2·73           |
| „     | Wincanton, Stowell Rec.   | 1·75           | XIX.   | Lairg H.R.S. ....          | ..             |
| „     | Weston-super-Mare .....   | 1·34           | „      | Scourie .....              | 4·18           |
| VI.   | Clifton, Pembroke Road    | 1·38           | „      | Watten H.R.S. ....         | 2·07           |
| „     | Ross, The Graig .....     | ·78            | XX.    | Dunmanway, Coolkelure      | 6·77           |
| „     | Wem, Clive Vicarage ...   | 1·75           | „      | Fermoy, Gas Works ...      | 3·08           |
| „     | Cheadle, The Heath Ho.    | 2·46           | „      | Killarney, Woodlawn ...    | 4·68           |
| „     | Worcester, Diglis Lock    | ·84            | „      | Tipperary, Henry Street    | 2·37           |
| „     | Coventry, Coundon .....   | 1·75           | „      | Limerick, Kilcornan ...    | 2·11           |
| VII.  | Ketton Hall [Stamford]    | 1·03           | „      | Ennis .....                | 2·39           |
| „     | Grantham, Stainby .....   | 1·20           | „      | Miltown Malbay .....       | 2·39           |
| „     | Horncastle, Bucknall ...  | ·71            | XXI.   | Gorey, Courtown House      | ·91            |
| „     | Workop, Hodsock Priory    | ·44            | „      | Mullingar, Belvedere...    | 1·91           |
| VIII. | Neston, Hinderton .....   | 2·19           | „      | Athlone, Twyford .....     | 1·89           |
| „     | Knutsford, Heathside ..   | 2·29           | „      | Longford, Currygrane...    | 2·24           |
| „     | Lancaster .....           | ..             | XXII.  | Galway, Queen's Coll...    | 2·01           |
| „     | Broughton-in-Furness..    | 4·63           | „      | Crossmolina, Enniscoe..    | 3·17           |
| IX.   | Ripon, Mickley .....      | ·55            | „      | Collooney, Markree Obs.    | 3·54           |
| „     | Scarborough, South Cliff  | 1·06           | „      | Ballinamore, Lawderdale    | 3·28           |
| „     | East Layton [Darlington]  | ·25            | XXIII. | Lough Sheelin, Arley ..    | 2·73           |
| „     | Middleton, Mickleton..    | ·82            | „      | Warrenpoint .....          | 1·70           |
| X.    | Haltwhistle, Unthank..    | 1·58           | „      | Seaforde .....             | 2·30           |
| „     | Bamburgh .....            | 1·03           | „      | Belfast, Springfield ..... | 3·73           |
| „     | Newton Reigny .....       | 1·23           | „      | Bushmills, Dundarave...    | 3·07           |
| XI.   | Llanfrechfa Grange .....  | 1·56           | „      | Stewartstown .....         | 2·28           |
| „     | Llandovery .....          | 3·25           | „      | Buncrana .....             | 2·53           |
| „     | Castle Malgwyn .....      | 2·17           | „      | Lough Swilly, Carrablagh   | 3·96           |
| „     | Builth, Abergwessin Vic.  | 4·66           |        |                            |                |

## DECEMBER, 1892.

| Div.     | STATIONS.<br>[The Roman numerals denote the division of the Annual Tables to which each station belongs.] | RAINFALL.   |                                 |                           |      |  |      | TEMPERATURE.    |      |                   |         | No. of Nights below 32° |     |
|----------|---|-------------|---------------------------------|---------------------------|------|--|------|-----------------|------|-------------------|---------|-------------------------|-----|
|          |   | Total Fall. | Difference from average 1880-9. | Greatest Fall in 24 hours |      | Days on which $\frac{1}{10}$ or more fell. | Max. |                 | Min. |                   |         |                         |     |
|          |   |             |                                 | Dpth                      | Date |  | Deg. | Date            | Deg. | Date.             |         |                         |     |
|          |   |             |                                 |                           |      |  |      |                 |      |                   | inches. | inches.                 | in. |
| I.       | London (Camden Square) ...  | 1·37        | — 70                            | 44                        | 1    | 11   | 54·5 | 15              | 16·7 | 27                | 18      | 24                      |     |
| II.      | Maidstone (Hunton Court)...   | 1·39        | — 85                            | 36                        | 1    | 10   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| III.     | Strathfield Turgiss .....   | 1·04        | — 97                            | 25                        | 1    | 13   | 52·3 | 15              | 13·2 | 27                | 20      | 24                      |     |
| IV.      | Hitchin .....   | 1·39        | — 64                            | 46                        | 1    | 10   | 48·0 | 14 <sup>a</sup> | 15·0 | 26 <sup>f</sup>   | 23      | ...                     |     |
| V.       | Winslow (Addington) .....   | 1·45        | — 1·00                          | 51                        | 1    | 10   | 53·0 | 15              | 11·0 | 27                | 24      | 24                      |     |
| VI.      | Bury St. Edmunds (Westley)  | 1·41        | — 83                            | 37                        | 1    | 10   | 52·0 | 16              | 22·0 | 26                | ...     | ...                     |     |
| VII.     | Norwich (Cossey) .....  | 1·08        | — 1·15                          | 24                        | 1    | 8  | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| VIII.    | Weymouth (Langton Herring)  | 1·93        | — 1·17                          | 54                        | 2    | 11   | 52·0 | 3, 15           | 24·0 | 30                | 15      | ...                     |     |
| IX.      | Torquay, Babbacombe ...   | 1·27        | — 2·14                          | 37                        | 2    | 14   | 52·6 | 3, 15           | 23·7 | 27                | 7       | 17                      |     |
| X.       | Bodmin (Fore Street) .....  | 3·02        | — 2·32                          | 58                        | 1    | 20   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XI.      | Stroud (Upfield) .....  | ·85         | — 1·60                          | 26                        | 1    | 13   | 50·0 | 14 <sup>b</sup> | 18·0 | 26                | 21      | ...                     |     |
| XII.     | Church Stretton (Woolstaston)   | 1·80        | — 1·25                          | 44                        | 1    | 14   | 51·0 | 15              | 19·5 | 26                | 21      | 24                      |     |
| XIII.    | Tenbury (Orleton) .....   | 1·29        | — 1·08                          | 40                        | 1    | 9  | 55·6 | 15              | 11·6 | 27                | 22      | 24                      |     |
| XIV.     | Leicester (Barkby) .....  | 1·25        | — 89                            | 50                        | 8    | 10   | 53·0 | 15              | 9·0  | 26                | 24      | 28                      |     |
| XV.      | Boston .....  | ·58         | — 1·27                          | 19                        | 10   | 5  | 50·0 | 15 <sup>c</sup> | 15·0 | 26                | 20      | ...                     |     |
| XVI.     | Hesley Hall (Tickhill) .....  | ·35         | — 1·63                          | 16                        | 8    | 7  | 54·0 | 18              | 10·0 | 29                | 23      | ...                     |     |
| XVII.    | Manchester (Plymouth Grove)   | 2·08        | — 1·36                          | 31                        | 4    | 13   | 53·0 | 18              | 15·0 | 26                | 20      | 25                      |     |
| XVIII.   | Wetherby (Ribston Hall) ...   | ·33         | — 2·11                          | 11                        | 16   | 4  | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XIX.     | Skipton (Arncliffe) .....   | 3·22        | — 3·59                          | 44                        | 8    | 14   | ...  | ...             | 14·0 | 28                | ...     | ...                     |     |
| XX.      | Hull (Pearson Park) .....   | 1·16        | — 1·11                          | 29                        | 9    | 13   | 53·0 | 17 <sup>d</sup> | 16·0 | 26                | 22      | 25                      |     |
| XXI.     | Newcastle (Town Moor) .....   | 1·22        | — 1·08                          | 34                        | 8    | 13   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXII.    | Borrowdale (Seathwaite) .....   | 9·06        | — 5·75                          | 180                       | 16   | 16   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXIII.   | Cardiff (Ely) .....   | 2·83        | — 1·72                          | 71                        | 1    | 15   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXIV.    | Haverfordwest .....   | 3·43        | — 1·56                          | 60                        | 9    | 17   | 52·9 | 16              | 15·0 | 27 <sup>g</sup>   | 10      | 15                      |     |
| XXV.     | Aberystwith, Gogerddan .....  | 3·95        | — 93                            | 79                        | 14   | 13   | 51·0 | 18              | 12·0 | 26 <sup>f</sup>   | 18      | ...                     |     |
| XXVI.    | Llandudno .....   | 2·09        | — 87                            | 27                        | 5    | 16   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXVII.   | Cargen [Dumfries] .....   | 2·17        | — 1·85                          | 41                        | 16   | 12   | 51·6 | 18              | 13·6 | 26                | 21      | ...                     |     |
| XXVIII.  | Jedburgh (Sunnyside) .....  | 1·20        | — 1·00                          | 45                        | 3    | 10   | 56·0 | 17              | 12·0 | 2, 3 <sup>h</sup> | 21      | ...                     |     |
| XXIX.    | Old Cumnock .....   | 2·31        | — 2·76                          | 60                        | 8    | 15   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXX.     | Lochgilpead (Kilmory) .....   | 4·62        | — 2·75                          | 90                        | 10   | 17   | ...  | ...             | 16·0 | 1, 25             | 21      | ...                     |     |
| XXXI.    | Oban (Craigvarren) .....  | 3·46        | ...                             | 45                        | 13   | 17   | 53·0 | 19              | 23·6 | 2                 | 12      | ...                     |     |
| XXXII.   | Mull (Quinish) .....  | ...         | ...                             | ...                       | ...  | ...  | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXXIII.  | Loch Leven Sluices .....  | 1·10        | — 2·21                          | 30                        | 10   | 8  | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXXIV.   | Dundee (Eastern Necropolis)   | ·90         | — 1·18                          | 20                        | 13   | 14   | 53·1 | 18              | 15·8 | 25                | 20      | ...                     |     |
| XXXV.    | Braemar .....   | ·71         | — 1·76                          | 15                        | 3    | 11   | 51·3 | 18              | 8·0  | 10                | 26      | 29                      |     |
| XXXVI.   | Aberdeen (Cranford) .....   | 1·23        | ...                             | 31                        | 6    | 18   | 52·0 | 17              | 18·0 | 25                | 17      | ...                     |     |
| XXXVII.  | Strome Ferry .....  | 5·22        | — 2·57                          | 82                        | 5    | 24   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXXVIII. | Cawdor [Nairn] .....  | 1·57        | — 89                            | 50                        | 3    | 15   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XXXIX.   | Dunrobin .....  | 1·48        | — 1·89                          | 40                        | 13   | 11   | 56·0 | 18              | 16·8 | 3                 | 20      | ...                     |     |
| XL.      | S. Ronaldsay (Roeberry) .....   | 2·66        | — 1·00                          | 75                        | 10   | 20   | 50·0 | 17              | 28·0 | 1                 | 14      | ...                     |     |
| XLI.     | Darrynane Abbey .....   | 5·25        | ...                             | 83                        | 2    | 25   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XLII.    | Waterford (Brook Lodge) ...   | 2·27        | — 1·37                          | 45                        | 24   | 18   | 54·0 | 14              | 24·0 | 27                | 12      | ...                     |     |
| XLIII.   | O'Briensbridge (Ross) .....   | 3·19        | ...                             | 67                        | 8    | 17   | 53·0 | ...             | 30·0 | ...               | 9       | ...                     |     |
| XLIV.    | Carlow (Browne's Hill) .....  | 1·57        | — 1·55                          | 26                        | 8    | 14   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XLV.     | Dublin (Fitz William Square)  | ·80         | — 1·36                          | 18                        | 8    | 10   | 55·5 | 18              | 21·9 | 27 <sup>g</sup>   | 14      | 20                      |     |
| XLVI.    | Ballinasloe .....   | 2·34        | — 1·08                          | 41                        | 24   | 18   | 50·0 | 17 <sup>d</sup> | 19·0 | 27                | 17      | ...                     |     |
| XLVII.   | Clifden (Kylemore) .....  | 5·76        | ...                             | 81                        | 8    | 23   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| XLVIII.  | Waringstown .....   | 2·15        | — 89                            | 31                        | 5    | 17   | 56·0 | 18              | 14·0 | 26                | 18      | 20                      |     |
| XLIX.    | Londonderry (Creggan Res.) ..   | 3·78        | — 43                            | 56                        | 8    | 22   | ...  | ...             | ...  | ...               | ...     | ...                     |     |
| L.       | Omagh (Edenfel) .....   | 2·60        | — 1·08                          | 39                        | 13   | 22   | 53·0 | 17              | 20·0 | 26 <sup>f</sup>   | 16      | 21                      |     |

<sup>a</sup> And 16, 18. <sup>b</sup> And 15. <sup>c</sup> And 17, 18. <sup>d</sup> And 18. <sup>e</sup> And 27. <sup>f</sup> And 28. <sup>g</sup> And 26.

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

# METEOROLOGICAL NOTES ON DECEMBER, 1892.

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

## ENGLAND.

STRATHFIELD TURGISS.—The first half of the month was damp and mild, but from the 16th to the close it was remarkably dry. The last ten days of the year were severely cold, the grass min. ther. recording  $8^{\circ}0$ , or  $24^{\circ}$  below the freezing point.

ADDINGTON.—The max. temp. was rather high from the 14th to the 18th, but with that exception the month was cold, particularly so after the 22nd, when a steady frost set in. At 9 a.m. on the 27th the ther. stood at  $12^{\circ}$ , and on the 28th the max. was only  $26^{\circ}$ . On the 25th the lake was covered with ice strong enough to carry skaters, and during the last week trees were beautifully covered with rime.

BURY ST. EDMUNDS.—No R or S fell after the 14th, and sharp, dry frost prevailed from the 24th to the end of the month. S on the 3rd, 6th, 8th, 9th, and 10th.

LANGTON HERRING.—In the early part of the month the changes of temp. were sudden and great. The ther. rose from  $31^{\circ}$  to  $45^{\circ}$  in the night of 8th–9th, and from  $32^{\circ}$  to  $47^{\circ}$  in the night of 14th–15th. Mean temp.  $1^{\circ}6$  below the average. The last 15 days of the month were fine, bright, very cold, and without any fall whatever. A solar halo was observed on Christmas Day.

BABBACOMBE.—A dry, variable month, with temp. slightly below the mean. Showery (though on many days less than .01 in. fell) every day from November 23rd to December 22nd, except on the 18th; dry during the last 9 days of December. Cold from 4th to 10th, and from 25th to 31st. The temp. at 9 a.m. fell  $16^{\circ}3$  from  $49^{\circ}7$  on 3rd to  $33^{\circ}4$  on 4th, and at 9 p.m. rose  $15^{\circ}5$  from  $35^{\circ}0$  on 13th to  $50^{\circ}5$  on 14th. The max. in shade rose to or above  $50^{\circ}0$  on 4 days; glazed frost on morning of 6th. The relative humidity (84) was lower than in any of the preceding 16 Decembers. Gales from W.S.W. on 1st and from E. on 31st. Solar halos on 2nd, 10th, and 24th. Lunar halos on 3rd and 4th. S and soft H on 4th and 5th. Fog on 3rd, 20th, and 28th.

BODMIN.—Rather wet the first fortnight; a little S on the 4th, and very cold on the 5th. Fine and frosty from the 25th to the end of the month, but very cold N.E. wind, especially on the 26th. A very stormy night for the last of the year; splendid moonlight for several nights.

WOOLSTASTON.—The first fortnight was very cold, and S fell on five days; this was succeeded by a few mild, warm days, but on the 22nd the frost set in again with great severity, and continued till the end of the month. Mean temp.  $35^{\circ}4$ .

TENBURY, ORLETON.—A very cold month, the mean temp. being nearly  $4^{\circ}5$  below the average. From the 11th to the 21st was fairly warm, but all the rest of the month was very much below the average, and from the 23rd to the end the cold was intense. S 2 inches deep at night on 5th.

MANCHESTER.—Damp, foggy, and very mild for the season from the 14th to 21st. Hard frost and fine wintery weather on the 22nd, 24th, 25th, and 30th. Mean temp.  $34^{\circ}$ . Heavy falls of S on the 4th and 5th. Thick fog on 2nd, 26th, and 27th, and very thick fog up to noon on the 28th. A decided thaw on the 11th.

## WALES.

HAVERFORDWEST.—The month commenced wet, and continued so up to the 19th, with occasional frost, but the general character of the weather was mild and wet, occasionally blowing very fresh. The wind shifted to S.E. on the 20th, and from that time to the 25th it was gloomy, the air very dry, with low mean temp., and blowing half a gale. On the night of the 25th a severe frost set in, with clear sky and calm air, which continued to the end of the month, the day temp. being below  $32^{\circ}$ , except on the 29th, skating going on every day; large ice floes in the river Cleddau.

## SCOTLAND.

CARGEN.—With the exception of a week of mild weather about the middle of the month, the temp. was very low, the mean ( $34^{\circ}3$ ) being  $4^{\circ}2$  below the average, and the mean of the last 10 days of the month as low as  $28^{\circ}6$ . Fluctuations were experienced on several occasions to the extent of  $20^{\circ}$  and upwards in 24 hours. N. and N.E. winds prevailed for 16 days.

JEDBURGH.—The temp. was low, with much black frost; out-door work a good deal hindered; ponds and rivers frozen over. S 3 inches deep on 1st, and 1 inch deep on 8th.

OLD CUMNOCK.—Frequent S from 3rd to 8th; almost continuous frost from the 20th to the close.

CAWDOR.—S every day except 7th from 2nd to 8th.

ROEBERRY.—The first part of the month until the 19th was very rough and wet, a heavy gale from W. to N.W. occurring on the night of the 17th and morning of 18th.

## IRELAND.

DARRYNANE ABBEY.—A very mild month, excepting a few days at the beginning. Constant fog during the last fortnight.

WATERFORD, BROOK LODGE.—Slight S on the 4th. Mean temp.  $41^{\circ}3$ .

O'BRIENSBIDGE, ROSS.—Low temp. prevailed in the early part of the month; it was then unusually high from the 14th to the 25th, and low again to the close. No storms or fogs.

DUBLIN.—A generally cold, dry, breezy month. Two periods of severely cold weather were separated from each other by a singularly mild and even warm spell, extending from the 14th to the 22nd inclusive. The cold weather in the earlier part of the month came from the N.W., and was accompanied by a good deal of S and H. That at the close of the month spread westward from the Continent to the British Isles, and was accompanied by strong S.E. winds and unusually dry weather. No serious gales were felt, and calms, with fog, prevailed during the frosty spells at the beginning and end of the month. The mean temp. ( $39^{\circ}6$ ) is  $1^{\circ}7$  below the average. A lunar halo appeared on the 31st. High winds were noted on 15 days, but attained the force of a gale on only two occasions, the 11th and 23rd. S or sleet on 4 days; H on 3 days. There were "silver thaws" on the 6th and 29th.

EDENFEL.—Heavy falls of S, with frost, prevailed during the first week, followed by a dull thaw. The third week and up to Christmas was mild, even to warmth, the mean temp. of the 17th reaching  $50^{\circ}5$ , and the weather gradually brightening. The last week was clear and dry, with no snow, but keen frost, the temp. on grass falling to  $13^{\circ}$  on the morning of the 27th.

## A LIGHTNING STORY.

BALL LIGHTNING.—The captain of the German steamer "Flandria" reports a curious instance of lightning on March 6th, 1892, in latitude  $38^{\circ}$  north and longitude  $41^{\circ}$  west. In the midst of a violent tempest a luminous ball, like a huge star, appeared in the midst of the blackened clouds, grew to a maximum, and then burst, followed by long rolls of thunder. Flashes of lightning spread in every direction, giving an intense light that blinded everyone for some minutes. This phenomenon was observed twice, the duration being about five seconds.—*Electrical Engineer*, December 25th.