

SYMONS'S METEOROLOGICAL MAGAZINE.

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THE BEN NEVIS OBSERVATORIES.

THE Meeting of the Scottish Meteorological Society, held in Edinburgh on July 23rd, was mainly devoted to the question of the closing of the Ben Nevis and Fort William Observatories. A memorandum was submitted by the Directors of the Observatories, who consist of the Council of the Scottish Meteorological Society together with one representative of the Royal Society, one of the Philosophical Society of Glasgow, and two of the Royal Society of Edinburgh. It commences with the statement :—

It has become necessary that the Observatories at the top of Ben Nevis and in Fort William be discontinued at the beginning of October next. The directors are not in possession of the funds needed for carrying them on beyond that date, and they cannot with any hope of success make further appeals to the public. During the last four years the great liberality of one gentleman, Mr. Mackay Bernard of Dunsinnan, made the continuation of the work at the Observatories possible, but there is no hope, in the opinion of the Directors, that the observatories can be continued as permanent institutions except by assistance from the State, and as yet no encouragement has been given to the efforts made to obtain this. In these circumstances the Directors feel obliged to close the Observatories, though they do so with much regret, believing that high-level observations are of the utmost importance in the study of meteorology, and are destined to play an important part in weather forecasting. In other countries the use of High-level Stations is greatly extending.

The observatory on Ben Nevis occupies the highest point in the British Isles—4,400 feet above the sea ; it was opened in 1883, and the observatory at Fort William, practically at sea level, was opened in 1890. The total expenditure on the two observatories has been fully £24,000, of which £17,000 has been subscribed by scientific bodies and the public, almost exclusively in Scotland. The Meteorological Council has granted £100 a year to Ben Nevis Observatory in return for a copy of the observations, and has given £250 a year to the Fort William Observatory, which is one of the Council's First Order stations. The Directors state that the grant by the Meteorological Council is to be withdrawn, whether the observatories are continued or not.

After reading the memorandum to the meeting, Sir Arthur Mitchell, Secretary to the Directors, made a further statement pointing out the admitted value of high-level observations. He said that application for assistance from the Government was made in 1898 and 1899, but the Directors were informed that in the view of the Treasury, "State aid to the study of meteorology is given solely through the medium of the Meteorological Council." He also made the following statements :—

Having high-level observations to compare with suitably associated observations at sea-level has a direct bearing on the study of meteorology broadly ; but it is also and everywhere held that the possession of such observations may be reasonably expected to assist directly in weather forecasting. It might perhaps be more correctly said—will certainly assist.

Weather forecasting in this country is still done by rule of thumb.

No effort, so far as known, has been made to turn the observations on Ben Nevis to account in forecasting weather

In the work of the two Ben Nevis Observatories the Directors did all that was possible to render the observations useful in forecasting. They could not themselves issue forecasts. This, indeed, can only be done from a Central Office receiving information by wire, at short intervals, from a great many stations near and remote.

Sir John Murray said that he had taken part in the heavy work of starting the observatory, which was founded for the purpose of making a great experiment, not of founding a permanent institution ; and in his opinion the experiment must now come to an end unless either the Government took it over, with all its responsibilities, or some private individual endowed it, and requested the Directors to continue their work.

None can regret more than we do the threatened termination of a splendid scientific enterprise, initiated with difficulty and continued through difficulties for nearly twenty years. It says much for the scientific enthusiasm of those who have actually carried on the work that there has been no lack of volunteers to undergo the hardships of residence on the top of Ben Nevis, which combines many of the worst features of life in a lighthouse and polar exploration. We cannot believe that the Meteorological Council could have come to the conclusion to withdraw their grant unless they had satisfied themselves that they were unable to utilize the observations for forecasting, or unless the other claims on their not too generous subsidy were held to be more pressing in the interests of an efficient weather service.

But it may possibly be that, on looking fully into the circumstances of the case, reason will be found for increasing the grant to the Meteorological Council, improving the status of the Ben Nevis Observatories, and advancing towards greater certainty in weather prediction. All meteorologists are desirous of advancing the science by every means in their power, and few will be found to deny that the maintenance of a properly-endowed and efficiently-manned observatory on Ben Nevis will yield valuable results. In any case it

would be a calamity if the observatories were closed until the fullest inquiry as to their value, and the possibility of obtaining State support, has been made.

Since writing the above, we have seen the report of a question and answer in Parliament on August 4th, which we reproduce from *The Times*. We hope that the promised action will result in arrangements satisfactory to all parties, and beneficial to the cause of scientific research.

MR. J. DEWAR (Inverness) asked the First Lord of the Treasury whether he had been made aware of the dissatisfaction in scientific circles at the impending closure of the observatories at Ben Nevis and Fort William owing to the lack of support of Government of these institutions, and whether he would order an inquiry to be made into the distribution by the Meteorological Council of the annual grant of £15,300, so as to secure that an adequate allowance be made to these stations of scientific observation, and whether, in the meantime, arrangements could be made for an interim maintenance grant pending the results of such an inquiry, so as to avert the interruption of the continuity of the meteorological records of the country.

MR. BALFOUR (Manchester, E.) said he was aware of the interest which this question excited and he had looked into the history of it. He confessed that he started with considerable prejudice against having an inquiry into the action of those scientific gentlemen who had been good enough to assist the Government in the expenditure of this money; but he found there was such an inquiry held about 20 years ago, in which an honourable friend of his who now took great interest in the subject took a leading part. The committee recommended in their report that the inquiry should be repeated from time to time, a recommendation that had not been followed. In the circumstances it would be right to have an investigation and to repeat it from time to time. This would involve no slur or slight on the scientific committee who allocate the funds. He observed that this was assuming an almost international question, but he did not think that the risk of Ben Nevis being deprived of the observatory implied any insult to Ben Nevis or through Ben Nevis to Scotland; it was a purely scientific matter and ought so to be treated.

METEOROLOGICAL WORK AT MARKREE OBSERVATORY.

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

MARKREE Observatory, Collooney, in the county of Sligo, Ireland, was founded in the year 1824 by the late E. J. Cooper, Esq., and from that date until the present meteorological registers were kept, though the earlier years were somewhat imperfect owing to his frequent absence from Markree. However, from 1833 to 1863, when Mr. Cooper died and the Observatory was for a time neglected, the records were as good and complete as possible.

The *Quarterly Journal of the Royal Meteorological Society* for April, 1884, contains a summary of rainfall and temperature for this period, contributed by Dr. Doberck, who was in charge of the Observatory

from 1874 to 1883, and is now Director of the Hong Kong Observatory.

There are unfortunately breaks in the record during the period 1863-1874, until the appointment of Dr. Doberck, inexperienced assistants having been employed to take the meteorological readings. The Observatory became a station of the second order about 1875, and since then weekly and monthly returns have been continuously made to the Meteorological Office, as well as rainfall returns to the late Mr. Symons and his successors, also weekly reports of temperature, rainfall, &c., to the Registrar General at Dublin. In May, 1883, Dr. Doberck was succeeded by the late A. Marth, the well-known astronomical computer *par excellence*, who remained in charge till his death in 1897, whilst I was appointed to succeed him in 1898.

Although this Observatory was at one time described as the "richest private observatory in the world," and from 1842 to 1860 was in charge of Mr. Graham (who is now at Cambridge), during which time observations of over 60,000 stars situated near the Ecliptic were made by him and published in four volumes at Dublin at the expense of the Government, of late years little but meteorological observations have been made.

Apart from the astronomical equipment, with which we are not concerned in this article, there is a unifilar magnetometer by Elliot, and also a dip-circle by Dover, which were added about 1882, but no magnet house having been built to shelter them, only preliminary work has been done with these instruments.

The meteorological instruments consist of the usual ones for a second order station, *i.e.*, a barometer, a dry and a wet bulb thermometer, a maximum and a minimum thermometer, a black bulb thermometer, a grass minimum thermometer, a Campbell Stokes sunshine recorder, and two rain gauges—one on the grass at a short distance from the Observatory, and the other on the wall sheltering the telescope, at a height of about $16\frac{1}{2}$ feet from the ground.

The rainfall observations for the period 1833-1863 give a total annual rainfall of 44·87 in. The original rain gauge was square (area one square yard), placed on the top of the library at a height of 16 feet above the ground, and gave a total mean rainfall in this position of 37·254 in. From comparison of this gauge with one of the ordinary pattern (5 in. diameter), placed at 6 in. above ground, during the period 1875-1881, it was found that this amount must be multiplied by 1·2045 to reduce it to the level of the lower rain gauge, thus giving the reduced total annual rainfall of 44·87 in.

The year of most rain was 1861, and that of least rainfall 1856, and the greatest mean rainfall is in the month of October, the least occurring in May, for this period (1833-1863). The table published by the Meteorological Office giving mean rainfall for each month and the results of observations made during the 25 years (1871-1895) gives the mean annual rainfall at Markree as 41·26 in. ; October,

with a mean of 4.45 in., being the wettest, and April, with 2.16 in., the driest month.

The records of temperature from 1833 to 1863 give as the mean annual temperature $48^{\circ}5$ F., the highest monthly mean being for July ($59^{\circ}2$) and the lowest for January ($39^{\circ}4$). The highest temperature recorded was in June, 1851 ($92^{\circ}0$), and the lowest during this period was in February, 1855 ($7^{\circ}2$ F.) The thermometer during the frost in February this year (1902) even on the grass never fell below 8° F.

The table published by the Meteorological Office giving maxima, minima and mean temperatures for the period 1875-1895 (21 years), gives as the mean temperature of Markree $47^{\circ}4$ F., the highest mean being for July and August ($57^{\circ}2$) and the lowest for December ($38^{\circ}9$).

During the earlier period the thermometers were read at 8 a.m. up to the 30th June, 1846, and at 10 a.m. subsequently up to 1863, so that the results obtained are not directly comparable with the later 9 a.m. and 9 p.m. observations. The maximum monthly rainfall (October) corresponds nearly with the epoch of the minimum range of temperature, and the minimum rainfall with that of the maximum range of temperature (May).

The record of sunshine for the period of 15 years (1881-1895) gives a mean annual duration of 1253.9 hours, or 28 per cent. of the possible duration; but this is perhaps slightly below the truth, since the growth of trees in the neighbourhood of recent years has cut off a small amount of the evening sunshine in the summer. The most sunny month is May (183.2 hours, or 37 per cent. of the possible amount), and the most sunless month December (34.3 hours, or 15 per cent.) The mean annual sunshine of 1253.9 hours is made up as follows:—

	hours.		hours.
January	42.4	July	128.3
February	64.6	August	122.5
March	105.3	September	103.1
April	150.0	October	90.3
May	183.2	November	57.7
June	172.2	December	34.3

The barometer has been regularly read each morning and evening at 9 a.m. and 9 p.m., and the results, corrected for temperature and altitude above sea-level (130 feet) are sent each month to the Meteorological Office. During the last twelve months some very high and some very low readings have been observed, the highest corrected reading having been 31.0 inches, on January 31st, 1902, in the morning, and the barometer having fallen below 28.5 inches on several occasions during the autumn of 1901.

Observations are also made of the wind force and direction, and it has been found that of late years the prevailing wind is S.E. Owing to its comparatively sheltered position the wind at Markree is generally of less intensity than in the neighbouring districts.

The mean amount of cloudiness is rather high, and in the winter months, in addition to heavy rainfall, there is much gloomy overcast weather, when nothing can be seen of the sky except during occasional intervals of frost.

On the whole it is clear that the climate at Markree is more equable than in the neighbourhood of London. Though the mean annual temperature is slightly lower, the extremes are not so great; the highest temperature in summer does not rise so high, nor the lowest temperature in winter fall so low. The rainfall, though greater, is not excessively so, and the amount of bright sunshine (1253·9 hours) is actually greater than that of London, whilst there are never any fogs to be compared with those with which Londoners are only too familiar.

The following table gives the mean monthly rainfall during the period 1833—1863, as well as that for 1871—1895; and the mean monthly temperature. The earlier observations are multiplied by the factor 1·2045 to render the results of the two gauges comparable, as explained above; but even so, there is considerable difference between them, the rainfall having apparently been less of late years than in the earlier period. The mean monthly temperatures are given for the period 1842—1863, and also for 1875—1895, but the values are not directly comparable, since the thermometers were read at 8 a.m. up to 30th June, 1846, and at 10 a.m. thence up to 1863, whilst the late results are from the mean of the 9 a.m. and 9 p.m. observations.

Months	Mean Rainfall.		Mean Temperature.	
	1833-1863	1871-1895	1842-1863	1875-1895
	in.	in.	°	°
January	4·16	3·87	39·4	39·1
February	3·34	2·76	40·1	40·4
March	2·99	2·72	42·3	42·0
April	2·96	2·16	46·7	46·0
May	2·44	2·46	51·7	49·8
June	3·67	2·94	57·3	55·1
July	3·96	3·76	59·2	57·2
August	4·34	4·10	58·5	57·2
September	3·91	3·83	54·5	53·5
October	4·67	4·45	48·1	47·3
November	4·25	4·05	42·4	42·7
December	4·18	4·16	40·9	38·9
Mean Annual...	44·87	41·26	48·4	47·4

[We are glad to learn that the meteorological observations at Markree are being continued, though the work of the observatory is stopped, and we hope that they will be made permanent. The value of a long series of careful observations in the West of Ireland is very great.—ED. S.M.M.]

Correspondence.

THE MOON AND RAINFALL.

To the Editor of Symons's Meteorological Magazine.

I DID not expect to be again the poor text of a lecture in these columns.

I am sincerely glad that Mr. Ellis has carried out a piece of work from which I was debarred, being much away from London (for health reasons). If he felt called by duty not only to ascertain truth (a truth of course strictly limited in scope), but also to convict an offender, be it so. I hope he may be wrong.

With much that he says I agree, while questioning its application. It might be well (the thing is arguable) that nothing should be published on those topics which is not in a sense "exhaustive," so that our sole pabulum would be elaborate memoirs coming out at long intervals. On the other hand, there seems to be a general consensus (good or bad) that truth may at least be also advanced in another way, —viz., by free suggestion and discussion, both conceived in a generous and philosophic spirit. A man may say, and may be usefully allowed to say, "Here is a point that seems worth investigating; here is a vein that looks promising; here is a striking regularity of weather through a series of years; can it be traced further back? let us see if it persists in the future." The thought of one mind is brought before a great many other minds, and by some of these it is turned over and over, carefully examined and tested, proving to be valuable or otherwise. The "fragmentary" work of A furnishes hints to B, C, and D, perhaps men with better opportunities, perhaps in other countries, and is by them extended and developed. Ideas are exchanged; the deadly stagnation to which we are always liable is broken up, and meteorology "does get forrid" a little. The method may involve some little waste of time in hunting up and reading; but where statement is clear, the disciplined mind quickly gets to the core of a thing, and "spots" that which is valuable. When the great constructive genius comes along (which is but rarely), he finds much of his material in the "fragmentary" products of humbler workers before him.

It seems to me that most of the papers brought before learned societies, or otherwise published in Europe, must be pronounced "fragmentary," more or less. Does the *Met. Mag.* contain much that is exhaustive in its long and useful series, or the "Quarterly Journal," which Mr. Ellis partly controls?

I am afraid the dock in which Mr. Ellis would place me must be pretty capacious to hold all that should join me in it. I could cite not a few recent papers which deal with the lunar question on a still more slender basis than that of about 150 synodical revolutions (12 years). The eminent meteorologist who lately wrote

you (M. Dechevrens) thought fit to bring before a French society a single year's rainfall at his station in China, in its relation to lunar phases. A still more heinous offence, surely, on Mr. Ellis's showing! I dissent entirely.

It will be seen that, with all respect for Mr. Ellis, and accepting what truth he establishes, I am still unable to think myself an egregious culprit for sending that quite unpretentious letter, or you foolish for printing it; but I may get further light on these things.

As to the general question of a contrast in wetness due to the moon, I have some reason to believe the last word has not been said.

ALEX. B. MACDOWALL.

THE MOON AND THUNDERSTORMS.

To the Editor of Symons's Meteorological Magazine.

IN the Journal of the British Astronomical Association for June (p. 342) it is mentioned that Greenwich observations show thunderstorms to be slightly more frequent about the time of new moon than at full; and that Senor Ventosa finds similar results from Madrid observations.

On examining my own registers I find that of the 97 thunderstorms I have recorded in the 30 years, 1872-1901 inclusive, 43 were within seven days before or after new moon, 54 within seven days before or after full moon, so that if any inference is to be drawn on the subject, the question requires to be examined afresh.

The old idea of the effect of the moon on the weather keeps cropping up from the days of Theophrastus, who says "the new moon is generally an epoch of bad weather," to the present time.

S. J. JOHNSON, F.R.A.S.

Melplash Vicarage, Bridport, July 9th.

DOUBLE SOLAR HALO.

To the Editor of Symons's Meteorological Magazine.

ON Friday, May 30th, 1902, when in Norway near Sand, lat. $59\frac{1}{2}^{\circ}$ N. long. $0^{\circ} 24'$ East, I was fortunate enough to witness a perfect double solar halo, viz., the ordinary halo of 22° and an elliptical halo (called by Bravais the *Halo circonscrit*), which is really formed by the junction of the upper and lower tangent arcs. The greatest distance between the outer and inner halo, at the points to right and left of the sun, I estimated as about 3° ; at the points immediately above and below the sun two halos were apparently superposed, the maximum brilliancy being above, where the colours orange-red, yellow and blue, showed up very brightly, and in that order from the sun. At the point immediately below, the same colors, though

easily distinguished, were not so bright as above. The lateral arcs were more clearly defined in the outer than in the inner halo, but both halos were perfect for at least an hour; the time was about 11 a.m., L.M.T., and the sun's altitude 50° approximately. Light clouds of the cirrus type prevailed, but there was no trace of parhelia or other forms of halo.

CHARLES L. BROOK.

Harewood Lodge, Meltham, July 3rd, 1902.

ROYAL METEOROLOGICAL SOCIETY.

THE concluding meeting of the present Session was held on Wednesday afternoon, June 18th, at the Society's Rooms, 70, Victoria Street, Westminster, Mr. R. Inwards, F.R.A.S., Vice-President, in the chair.

Mr. L. H. Proud and Dr. H. Vallance were elected Fellows of the Society.

Mr. F. Campbell Bayard read a paper entitled "English Climatology, 1891-1900," which was a discussion of the climatological data printed in the *Meteorological Record*. In 1874 the Royal Meteorological Society commenced the organization of a series of "second-order" stations at which the observations are made twice a day on a uniform plan, so that the results are strictly comparable with each other. In addition to these, the Society in 1880 organized another class of stations, termed "climatological," at which the observations are made once a day, viz., at 9 a.m. Mr. Bayard on a former occasion worked up the results from the climatological stations for the 10 years 1881-1890, and in the present paper he gives the averages from 69 stations for the 10 years 1891-1900. The elements dealt with are:—(1) temperature at 9 a.m.; (2) mean minimum temperature; (3) mean maximum temperature; (4) mean temperature; (5) relative humidity; (6) amount of cloud; (7) rainfall; and (8) number of rainy days. The results form a valuable contribution to the climatology of the British Isles.

The Chairman, in expressing thanks to Mr. Bayard for his paper, said that few people could realize the amount of labour represented by these detailed investigations.

Mr. W. Marriott was glad that Mr. Bayard had discussed the observations published in the *Meteorological Record*, and was pleased to see that the results agreed so well together. After referring to the difficulties connected with the proper working of the wet bulb thermometer during frost, Mr. Marriott exhibited maps of relative humidity for January and July, which he had prepared from the figures given by Mr. Bayard. In January the greatest relative humidity prevailed over the eastern part of England from the Humber to the Severn, except along the south coast, while the driest part was the west coast of Wales. In July the greatest

dryness was over London and practically the whole of the home counties, and the greatest humidity was in the northern and in the south-western parts of the country. He also exhibited maps of England, showing the amount of cloud in the same manner. From these it appeared that in January the greatest amount of cloud was over the Thames valley and the manufacturing districts of Lancashire (London being the most cloudy of all), while the least cloud was along the south coast. In July the greatest amount of cloud was over the north-western part of the country, excepting along the coast, while the districts with the least amount of cloud were the south coast and on the coasts of North Wales and Lancashire.

Dr. Theodore Williams said that Mr. Bayard's paper would help to place British meteorology on a broader basis. Medical men should feel particularly obliged, since health was largely dependent upon climate, and this paper supplied valuable facts.

Dr. H. R. Mill hoped that Mr. Bayard would combine the results of his two papers, so as to furnish 20 years' averages. He pointed out that the January map, exhibited by Mr. Marriott, showed a striking agreement of relative humidity with geological formation, the whole of the area with the highest humidity being over those parts of the country where nearly level plains of clay covered much of the surface, and tended to retain moisture on the land. The regions of low relative humidity, on the other hand, though subject to heavy rainfall, were made up of steep slopes, allowing a rapid run off.

Mr. C. Harding having referred to the distribution of temperature and rainfall, and Mr. J. Hopkinson having pointed out that the paper was a complete justification of the continuance of the *Meteorological Record*, Mr. Bayard briefly replied to the remarks.

A paper was submitted by Mr. W. L. Dallas on "Earth Temperature Observations recorded in Upper India," in which he discussed the observations made on the temperature of the soil at three stations, viz., Lahore, the capital of the Punjab; Dehra Dun, in the north-west of the North Western Provinces; and Jaipur, the capital of the native state of that name. The observations, which were made at depths varying from 4 inches to $45\frac{1}{2}$ feet below the surface, extended from 1884 to 1899.

METEOROLOGICAL NEWS AND NOTES.

METEOROLOGICAL KITE FLYING has been taken up in several parts of Europe. M. Teisserenc de Bort, together with Dr. Paulsen, Director of the Danish Weather Service, and Professor Hildebrandson, of Stockholm, were engaged during July in experiments in the middle of Jutland, where some records from great heights were obtained, and we understand that it was their intention to proceed later to the Island of Oeland, off the east coast of Sweden, in order to continue the work.

THE KITE EXPERIMENTS AT CRINAN, being carried out by Mr. Dines for the joint Committee of the British Association and the Royal Meteorological Society, are being continued during the month of August. During the week from July 28th to August 2nd, ascents were made daily or twice daily, and records obtained from heights up to 8950 feet, or nearly $1\frac{3}{4}$ miles.

THE INTERNATIONAL COUNCIL FOR THE STUDY OF THE SEA held its first meeting in Copenhagen from July 22nd to 26th, when Great Britain, Germany, Holland, Denmark, Norway, Sweden, Finland and Russia were represented. The British delegates were Sir Colin Scott Moncrieff and Professor D'Arcy Thompson, who were accompanied by Dr. H. R. Mill and Mr. W. Garstang as advisers on oceanography and fisheries respectively. The Council decided that on account of the conditions attached by many of the participating governments to their promises of support, the primary work of the Council must be the investigation of problems directly bearing on the capture of fish. It is to be feared accordingly that the advantages of the international research to Meteorology may be less than the proposals of the Christiania Conference had led us to hope. The indirect results will, however, be of value.

THE DROUGHT IN AUSTRALIA has assumed the most serious dimensions, and we have received a large number of newspaper cuttings from correspondents describing the state of things in various parts of the commonwealth. It is difficult in the absence of precise data to compare the condition with that of previous dry periods; but many old residents assert that the present dearth of rain is unprecedented. The almost complete failure of rain in the interior during the first half of 1902, coming after a series of exceptionally dry years, has proved most destructive to sheep, and at the end of May the mail coaches ceased running over 2000 miles of roads on account of the impossibility of obtaining fodder for the horses.

WINTRY WEATHER IN SUMMER is no new experience, though its occurrence is rarely so pithily recorded as in the following extract from Richard Allyn's "Narrative of the Battle of La Hogue in 1692," to which attention was called by Professor J. K. Laughton in *The Times* of June 12th this year:—

"June 24th [o.s.].—This morning the wind sprung up fresh, northerly, with filthy rainy weather. The Almanacs call this Midsummer Day. It may have been so formerly, but I am sure it is not so now, for we have had no summer yet. Good God! how it blows and rains. I dare challenge any day in winter to compare with this Midsummer Day for cold, rainy, and stormy weather.

"June 25th.—Why certainly the whole course of nature is inverted. Lord! here's winter all the year round, and the weather as bad or worse than it was on Midsummer Day. We were in hopes to have dated an end of winter from Midsummer Day, but, alas, I find it will be winter still."

JULY, 1902.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.			Days on which "01 or more fell.	TEMPERATURE.				No. of Nights below 32°.			
		Total Fall.	Differ- ence from average 1890-9.	Greatest Fall in 24 hours. Dpth Date		Max.		Min.					
						Deg.	Date	Deg.	Date.	In shade.	On grass.		
		inches.	inches.	in.									
I.	London (Camden Square)	1.40	— .85	.45 1	11	85.1	15	44.9	12	0	0		
II.	Tenterden	1.39	— 1.21	.61 1	13	84.0	15	43.5	12	0	0		
"	Hartley Wintney	1.29	— 1.07	.30 1	10	83.0	8	41.0	22 ^a	0	0		
III.	Hitchin	1.88	— .53	.92 1	10	82.0	13	41.0	11	0	...		
"	Winslow (Addington)	1.27	— 1.20	.25 9	9	85.0	14	37.0	12	0	0		
IV.	Bury St. Edmunds (Westley)	1.22	— .69	.30 9	8	86.0	15	40.0	12	0	...		
"	Norwich (Brundall)	2.11	— .76	.33 9	14	83.4	15	40.6	3	0	0		
V.	Winterborne Steepleton	1.83	...	.81 19	10	78.4	15	38.2	12	0	1		
"	Torquay	2.25	...	1.05 19	11	77.5	15	47.5	22	0	0		
"	Polapit Tamar [Launceston]..	2.36	— .66	1.02 19	10	79.9	14	36.0	12	0	0		
VI.	Stroud (Upfield)	1.28	— 1.33	.38 25	11	80.0	14	47.0	11	0	...		
"	Church Stretton (Woolstaston)	1.54	— .79	.37 25	15	80.0	14	41.0	22	0	0		
"	Worcester (Diglis Lock)	1.51	— .25	.40 1, 24	11	...	...	...	...	...	...
VII.	Boston	1.35	— .77	.20 1, 9	12	84.0	15	43.0	3	0	...		
"	Hesley Hall [Tickhill].....	1.62	— .35	.48 25	13	81.0	14	39.0	25	0	...		
"	Derby (Midland Railway).....	1.40	— .91	.38 25	12	84.0	14	40.0	12	0	...		
VIII.	Manchester (Plymouth Grove)	2.14	— .98	.45 26	16	...	...	...	...	...	...
IX.	Wetherby (Ribston Hall) ...	2.39	— .10	.56 25	14	...	...	...	...	...	...
"	Skipton (Arncliffe)	4.68	— .35	.98 25	19	...	...	...	...	...	...
"	Hull (Pearson Park)	2.43	— .11	.55 25	18	84.0	15	40.0	25	0	0		
X.	Newcastle (Town Moor)	3.18	— .49	1.53 26	19	...	...	...	...	...	...
"	Borrowdale (Seathwaite).....	7.05	— 2.36	1.33 9	17	74.8	4	42.4	2	0	...		
XI.	Cardiff (Ely)	1.98	— 1.26	.73 19	11	...	...	...	...	...	...
"	Haverfordwest	2.89	— .45	1.13 25	7	74.3	14	41.2	12	0	0		
"	Aberystwith (Gogerddan) ...	1.90	— 1.72	.54 4	11	79.0	6	34.0	14	0	...		
"	Llandudno	1.54	— 1.04	.47 26	15	73.5	6	44.5	25	0	...		
XII.	Cargen [Dumfries]	2.48	— .86	.77 25	13	71.0	5, 6	35.0	25	0	...		
XIII.	Edinburgh (Royal Observatory)	2.43	...	.90 26	16	67.9	6	43.6	2	0	0		
XIV.	Colmonell	3.06	— .14	.63 12	16	76.0	4, 6	37.0	20	0	...		
XV.	Tighnabruach	4.75	...	1.40 12	16	68.0	1	39.0	24	0	...		
"	Mull (Quinish)	3.51	— .60	.52 3	25	...	...	...	...	...	...
XVI.	Loch Leven Sluices	2.89	— .18	.81 27	14	...	...	...	...	...	...
"	Dundee (Eastern Necropolis)	2.75	— .39	.80 23	13	75.9	15	39.9	2	0	...		
XVII.	Braemar	1.84	— .93	.42 26	17	70.0	5	34.6	26	0	2		
"	Aberdeen (Cranford)	4.18	— 1.55	1.06 26	20	80.0	15	38.0	24	0	...		
"	Cawdor (Budgate)	3.51	— .09	1.06 9	21	...	...	...	...	...	...
XVIII.	Strathconan [Beaul]	2.33	— 2.33	.56 8	11	...	...	...	...	...	...
"	Glencarron Lodge	4.57	— 2.33	.80 9	24	64.7	5	39.7	24	0	...		
XIX.	Dunrobin	3.54	— .84	1.31 17	17	70.0	6	38.0	24	0	...		
"	S. Ronaldshay (Roeberry) ...	2.32	— .57	.41 28	24	67.0	3	40.0	23	0	...		
XX.	Darrynane Abbey	3.40	— .32	1.82 3	17	...	...	...	...	...	...
"	Waterford (Brook Lodge) ...	3.41	— .03	1.99 25	7	75.5	1	43.5	21	0	...		
"	Broadford (Hurdlestown) ...	...	...	...	...	...	...	...	...	...	...
XXI.	Carlow (Browne's Hill)	2.68	— .27	1.14 25	12	...	...	...	...	...	...
"	Dublin (Fitz William Square)	3.16	— .58	1.34 25	17	74.8	13	45.1	21	0	0		
XXII.	Ballinasloe	1.62	— 1.65	.84 25	21	73.0	16	41.0	28	0	...		
"	Clifden (Kylemore)	3.40	— 3.19	.56 2	16	...	...	...	...	...	...
XXIII.	Seaforde	3.43	— .24	1.29 25	18	76.0	8	39.0	24	0	0		
"	Londonderry (Creggan Res.)	3.90	— .20	.65 19	21	...	...	...	...	...	...
"	Omagh (Edenfel)	3.95	— .40	.90 25	22	72.0	...	36.0	...	0	1		

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

a—and 23.

SUPPLEMENTARY TABLE OF RAINFALL,
JULY, 1902.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	1·64	XI.	Castle Malgwyn	2·35
II.	Dorking, Abinger Hall .	1·27	„	Builth, Abergwesyn Vic. ...	...
„	Sheppey, Leysdown	1·62	„	Rhayader, Nantgwillt ...	...
„	Hailsham	1·54	„	Lake Vyrnwy	2·05
„	Crowborough.....	1·68	„	Ruthin, Plâs Drâw	1·49
„	Ryde, Beldornie Tower..	·96	„	Criccieth, Talarvor	1·97
„	Emsworth, Redlands ...	1·57	„	I. of Anglesey, Lligwy..	1·87
„	Alton, Ashdell	1·08	„	Douglas, Woodville.....	3·60
„	Newbury, Welford Park	·82	XII.	Stoneykirk, Ardwell Ho.	3·06
III.	Oxford, Magdalen Coll..	·65	„	Dalry, Old Garroch	3·18
„	Banbury, Bloxham	1·17	„	Moniaive, Maxwellton Ho.	2·40
„	Pitsford, Sedgbrook ...	1·39	„	Lilliesleaf, Riddell	2·85
„	Huntingdon, Brompton.	1·30	XIII.	N. Esk Res. [Penicuik]	2·80
„	Wisbech, Bank House...	1·69	XIV.	Glasgow, Queen's Park..	2·63
IV.	Southend	1·12	XV.	Inveraray, Newtown ...	4·87
„	Colchester, Lexden	1·07	„	Ballachulish, Ardsheal...	3·98
„	Saffron Waldon, Newport	1·55	„	Islay, Eallabus	4·37
„	Rendlesham Hall	4·21	XVI.	Dollar.....	3·65
„	Swaffham	2·70	„	Balquhider, Stronvar...	2·94
V.	Salisbury, Alderbury ...	1·22	„	Coupar Angus Station...	2·33
„	Bishop's Cannings	1·11	„	Blair Atholl ...	1·75
„	Blandford, Whatcombe .	...	„	Montrose, Sunnyside ...	2·79
„	Ashburton, Druid House	3·44	XVII.	Keith H.R.S.....	5·36
„	Okehampton, Oaklands.	3·14	XVIII.	Fearn, Lower Pitkerrie..	2·90
„	Hartland Abbey	3·12	„	S. Uist, Askernish .....	...
„	Lynmouth, Rock House	2·41	„	Invergarry	2·52
„	Probus, Lamellyn	2·35	„	Aviemore, Alvie Manse.	2·27
„	Wellington, The Avenue	2·12	„	Loch Ness, Drumnadrochit	1·82
„	North Cadbury Rectory	1·65	XIX.	Invershin	2·30
VI.	Clifton, Pembroke Road	1·27	„	Bettyhill	3·16
„	Ross, The Graig .....	...	„	Watten H.R.S.....	2·39
„	Shifnal, Hatton Grange	1·58	XX.	Dunmanway, Coolkelure	2·41
„	Wem, Clive Vicarage ...	1·02	„	Cork, Wellesley Terrace	2·40
„	Cheadle, The Heath Ho.	1·82	„	Killarney, District Asyl.	1·66
„	Coventry, Priory Row ..	1·36	„	Caher, Duneske .....	...
VII.	Market Overton	1·22	„	Ballingarry, Hazelfort...	2·33
„	Grantham, Stainby	1·43	„	Milton Malbay	1·80
„	Horncastle, Bucknall ...	1·24	XXI.	Gorey, Courtown House	2·86
„	Workshop, Hodsck Priory	1·62	„	Moynalty, Westland ...	3·43
VIII.	Neston, Hinderton	2·24	„	Athlone, Twyford	2·52
„	Southport, Hesketh Park	2·37	„	Mullingar, Belvedere ...	3·60
„	Chatburn, Middlewood.	3·49	XXII.	Woodlawn	2·29
„	Duddon Val., Seathwaite Vic.	5·05	„	Westport, Murrisk Abbey	2·93
IX.	Baldersby	1·88	„	Crossmolina, Enniscoe ..	2·08
„	Scalby, Silverdale	2·17	„	Collonoy, Markree Obs.	2·71
„	Ingleby Greenhow Vic..	3·54	XXIII.	Enniskillen, Model Sch.	...
„	Middleton, Mickleton ...	3·55	„	Warrenpoint.....	4·72
X.	Beltingham	2·66	„	Banbridge, Milltown ...	3·59
„	Bamburgh .....	...	„	Belfast, Springfield .....	...
„	Keswick, The Bank	2·72	„	Bushmills, Dundarave..	3·38
XI.	Llanfrechfa Grange	1·54	„	Stewartstown	3·53
„	Treherbert, Tyn-y-waun	3·73	„	Killybegs	3·52
„	Llandoverly	1·58	„	Horn Head	3·45

METEOROLOGICAL NOTES ON JULY, 1902.

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

ENGLAND.

LONDON, CAMDEN SQUARE.—After a sharp TS on 1st the weather was generally fine and warm until the 18th, broken only by R on 9th and a TS on 10th. The last fortnight was cold and inclement with slight R nearly every day. Mean temp. $62^{\circ}\cdot6$ or $0^{\circ}\cdot7$ below the average.

UXBRIDGE, HAREFIELD PARK.—On 1st $\cdot6$ in. of R fell in 38 mins.

ABINGER HALL.—Very variable both as regards temp. and R.

TENTERDEN.—Slight TS with heavy R on evening of 1st, but only showers later in month. Drought becoming as serious as in other dry years, and wells and ponds lower than in 1901. Duration of sunshine, 222 hours.

CROWBOROUGH.—With absolutely dry periods from 2nd to 8th and from 11th to 16th, the R, though much below the average of 31 years, was fairly distributed over the remaining days, and there was no urgent need of moisture.

HARTLEY WINTNEY.—Dry and cold with remarkably low temp. The 14th, 15th and 16th were cloudless. Ozone on 4 days with a mean of $2\cdot3$. TS on 1st.

HITCHIN.—The coldest and most sunless July ever remembered.

COLCHESTER, LEXDEN.—Several hot days during the first half. From 18th to close it was remarkably cool with much cloud. TS on 9th.

BURY ST. EDMUNDS, WESTLEY.—Dry with great variation in temp. Very high wind on 26th. T on 3 days.

BISHOP'S CANNINGS.—R $1\cdot28$ in., and rainy days 3, below the average. Harvest will be late. T and H on 10th.

WINTERBOURNE STEEPLTON.—Only between the 6th and 17th was the weather really warm. Mean temp. $57^{\circ}\cdot2$ or $2^{\circ}\cdot9$ below the average of 9 years.

TORQUAY, CARY GREEN.—R $\cdot11$ in., and mean temp. $3^{\circ}\cdot7$, below the average. Duration of sunshine $245\cdot7$ hours, being $27\cdot8$ hours above the average. Mean amount of ozone $4\cdot3$.

OKEHAMPTON OAKLANDS.—Fine and dry until 19th, when there was a heavy downpour. The rest of the month was wet and ungenial.

WELLINGTON, THE AVENUE.—The first half was fairly fine with some brilliant days, but in the last fortnight no day had a max temp. of 70° , and many were sunless.

NORTH CADBURY RECTORY.—The coolest July in 6 years. The first 18 days had nice sunny weather, splendid for hay. The remaining 13 were cool, gloomy and rather windy and showery.

CLIFTON, PEMBROKE ROAD.—Fine warm weather till 18th except 9th and 10th. The rest of the month was cold and ungenial with little sunshine and R on most days. Total R less than half the average.

HULL, PEARSON PARK.—Very variable weather. Frequently cold and unpleasant with a meagre amount of sunshine.

WALES AND THE ISLANDS.

HAVERFORDWEST.—Fine generally but broken, considerable falls of R occurring on 19th and 25th. Temp. generally low, the shade max. exceeding 70° on 7 days only. Strong winds very prevalent. Crops everywhere looking well.

ROSSETT, TREVELYAN HALL.—The min. temp. on 25th was $35^{\circ}\cdot5$, the lowest in July during 31 years. There is a persistent run of low temp., consequent on cloudy skies and unsettled weather.

DOUGLAS, WOODVILLE.—Another abnormally cold month, probably coldest July on record, the temp. being persistently below the average throughout. The wind remained obdurately in the N. and during the last fortnight was very strong. All crops very backward.

SCOTLAND.

LILLIESLEAF, RIDDELL.—Wind very cold and mostly northerly. An abundance of "silent" TSS and R showers, but hay was got well in. Fruit and vegetables at least a month late.

MULL, QUINISH.—Cold and showery from first to last.

COUPAR ANGUS.—R 62 in. above the average, falling sparingly on 14 days and excessively on 2. Except the first two weeks the weather was more like May than July. Normal temp. for the first half and cold later.

WATTEN, H.R.S.—The first part was dull and showery growing weather. The latter and greater part was cloudy, cold and wet.

S. RONALDSHAY ROEBURY.—Cold and changeable. Mean temp. 50°·5, or 4°·6 below the average.

IRELAND.

DARRYNANE ABBEY.—On the whole fine and fairly warm.

CORK, WELLESLEY TERRACE.—The mean temp. was the lowest in July for 20 years. There were only 5 days worthy of the name of summer.

MILTOWN MALBAY.—Moderately warm and very dry. All craggy and stony lands burned up and pastures burned and wilted. Hay crops scanty but crops looking well.

DUBLIN, FITZWILLIAM SQUARE.—The month opened well with spells of summer-like weather in the first fortnight, but after the 17th the temp. was low and cold N.W. winds prevailed with sunless skies. Mean temp. 59°·6, or 0°·7 below the average.

OMAGH, EDENFEL.—The brilliant summer weather of the latter part of June was not repeated in July. On the contrary, the R was above and temp. below the average, and much difficulty was experienced in saving the hay crop, which was still uncompleted at the end. Cereals and green crops will be late, but of nearly average quantity.

THE TEMPERATURE OF JULY, 1902, IN LONDON.

A COMPARISON of the average temperature of July with the means of 40 years' observations at Camden Square shows that, considering the month as a whole, the conditions differed very slightly from the normal. This is chiefly due to the fact that two bursts of warm weather, from 4th to 8th and from 13th to 17th, neutralised the cold and unseasonable character of the remainder of the month. Except during these two periods the mean temperature rose above the average on only one day, the 26th, whilst the maximum failed to reach 75° except on the 1st, and the minimum only exceeded 55° on three occasions. The lowest temperatures were, however, not remarkable, since lower July maxima have been recorded in 8 years and lower minima in 19 during 45 years.

Dividing the month into two halves, we get the following results:—

	Mean max.	Diff. from average.	Mean temp.	Diff. from average.	Mean min.	Diff. from average.
1st to 16th	77°·1	+3°·0	65°·1	+1°·8	54°·1	+0°·1
17th to 31st	69°·4	—4°·7	60°·1	—3°·2	52°·0	—2°·0

showing that the cold weather was chiefly confined to the latter part. The lowest minima took place on the 3rd and 12th, whilst the second half of the month was characterised rather by persistent low temperature than by any remarkably low readings. The averages for this period show that, although cold, it was by no means unique, since the mean maximum for the whole month of July has been lower in three years than that of the colder half of July, 1902, the mean temp. in three, and the mean minimum in five years. In other parts of the country there is reason to believe that the month was relatively much colder than in London.

That the bad character given to the weather of July in the columns of the press is not due to any particular cloudiness is shown by the fact that the average amount at Camden Square was only 5·6, or 0·1 below the average, and that for the two halves 4·6 and 6·7, whilst in July, 1879, the average for the whole month reached 7·9, and in 1888 7·7, and 6·7 has been exceeded on four occasions. The total duration of sunshine at Westminster was 179 hours against an average of 186 hours.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEBRUARY, 1902.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
London, Camden Square	52·7	28	15·8	16	40·5	31·0	32·5	87	76·0	14·3	1·13	11	7·1
Malta.....	67·4	15	40·4	17	62·8	50·2	50·7	84	121·7	34·1	2·21	8	4·8
Lagos, W. Africa .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	94·2	10	53·3	25	79·6	61·4	58·7	68	...	...	·52	3	3·6
Durban, Natal	95·2	20	60·5	10	87·1	68·6	...	...	151·3	...	2·09	12	4·4
Mauritius.....	88·4	3	68·0	3	84·1	73·1	71·0	78	155·2	62·5	17·52	21	7·1
Calcutta .....	...	...	...	...	...	...	...	...	140·0	41·1	·02	1	1·7
Bombay.....	90·3	8	64·1	7	85·1	70·0	66·3	70	139·6	55·7	·00	0	2·2
Madras.....	90·2	26	62·2	6	86·4	67·3	67·4	75	141·2	58·2	·05	1	2·4
Kodaikanal	71·1	2	43·5	10	65·0	46·9	...	56	134·6	29·3	1·66	3	0·3
Colombo, Ceylon.....	92·6	23	69·8	7	80·4	74·3	70·1	75	158·0	64·4	2·90	4	2·8
Hongkong.....	75·3	25	40·5	4	65·0	54·3	46·6	60	128·5	...	·02	2	4·0
Melbourne.....	95·3	9	47·3	5	74·7	54·9	49·5	62	159·6	36·9	·95	8	5·9
Adelaide	111·4	11	51·6	16	83·0	59·0	50·8	50	167·9	45·4	·35	5	3·8
Coolgardie	104·5	7	49·8	24	89·3	59·6	58·4	49	...	...	1·35	4	2·2
Sydney	96·3	6	58·6	14	79·1	65·0	57·9	66	144·7	46·8	·34	12	4·9
Wellington	76·5	9	47·0	13a	69·1	56·1	51·9	67	124·0	38·0	1·38	12	5·0
Auckland	79·0	4	54·0	15	72·2	59·6	53·9	66	144·0	52·0	·41	7	4·0
Jamaica, Negril Point..	86·0	3	62·0	19	83·3	70·7	71·0	82	...	...	·10	2	...
Trinidad	89·0	18b	65·0	4, 5c	87·3	67·4	66·6	68	162·0	58·0	·51	2	...
Grenada.....	85·0	3	69·0	4	82·3	72·9	68·7	73	150·0	...	1·08	8	2·4
Toronto	45·0	28	1·0	5	28·1	14·4	18·6	80	61·5	—2·2	1·50	9	5·7
Fredericton, N.B.	50·3	27	—22·0	12	31·5	9·9	13·8	67	...	...	3·38	11	6·5
Winnipeg	44·0	22	—28·7	3	21·1	—0·2	...	...	...	...	·54	6	6·2
Victoria, B.C.	55·4	20	29·2	1	48·5	40·7	...	...	...	...	2·47	19	8·1
Dawson, Yukon	24·8	21	—49·0	2	0·9	—15·2	...	...	...	...	·20	1	...

a—and 17. b—and 25. c—and 17 & 24.

REMARKS.

MALTA.—Mean temp. of air 56°·2, or 2°·1 above the average. Mean hourly velocity of wind 10·9 miles, or 1·0 below the average. Mean temp. of sea 59°·9. J. F. DOBSON.

MAURITIUS.—Mean temp. 0°·5 below, and rainfall 10·47 in. above, the average. Mean hourly velocity of wind 15·7 miles, or 4·5 miles above the average. From February 2nd to 18th four cyclones occurred in the South Indian Ocean. T. F. CLAXTON.

MADRAS.—Mean temp. below average during the latter half of the month, on account of low night temp. Bright sunshine 242·1 hours. Evaporation 4·55 in. A. MOFFAT.

COLOMBO.—Mean temp. 80°·4, or 0°·2 above, dew point 0°·3 below, and R 2·63 in. above, their respective averages. Mean hourly velocity of wind 6·5 miles; prevailing direction N. E. to N. W. H. O. BARNARD.

HONGKONG.—Mean temp. 59°·5, or 1°·8 above, R 1·30 in. below, bright sunshine 200·5, or 122·8 above, their respective averages. Mean hourly velocity of wind 12·7 miles. F. G. FIGG.

ADELAIDE.—Mean temp. 71°·0 being 3°·2 below 45 years' average. Moderate rains fell over coastal district, but interior very dry, and monsoon rain of N. territory much under the average. C. TODD, F.R.S.

SYDNEY.—Mean temp. 1°·1 above, R 4·64 in. below, humidity 6·9 below, their respective averages. H. C. RUSSELL, F.R.S.