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METEOROLOGY AT THE BRITISH ASSOCIATION.

BELFAST MEETING, 1902.

THE British Association for the Advancement of Science met this year at Belfast from September 10th to 17th, and although the number attending was smaller than last year—smaller even than at the previous Belfast meeting in 1874—various circumstances conspired to make the gathering unusually pleasant and successful. The weather certainly did not enter into the conspiracy to please, but it did not succeed in doing more harm than spoiling a garden party and reducing the comfort of several excursions. The citizens of Belfast received the visiting members with a friendly heartiness which gives an intenser meaning to the phrase "Irish hospitality" in the minds of those who experienced it. The meeting-rooms were conveniently arranged and fully satisfied the wants of the Sections. The Sectional meetings themselves disposed of an unusual number of papers descriptive of sound scientific work.

As regards Meteorology the meeting was both richer and poorer than those which preceded it. Richer, because a new sub-section of Section A, Physics, was constituted to deal with papers on "Astronomy and Cosmical Physics," including in this comprehensive title Seismology, Mathematical Geography, Terrestrial Magnetism and Meteorology: poorer, because only one purely meteorological paper and one purely meteorological report were submitted to the Section. An interesting address was given by Professor Schuster, chairman of the sub-section, which dealt with some of the essential features of meteorological observations in a fresh and even surprising manner. The address, which we hope to publish in abstract, opened a door to controversy, and although we welcome it as a wholesome criticism, we cannot agree with all its conclusions.

It was at the Belfast meeting in 1874 that Mr. Symons established the Meteorologists' Breakfast on a co-operative basis, as a regular institution, and although the short notice consequent on delay in the publication of the lists of members made the number attending a small one, the breakfast this year afforded a pleasant opportunity for friendly intercourse between meteorological workers. It took

place on Tuesday, 16th September, at Princes Restaurant, when the following were present:—

Fabyan Amery, Ashburton, Devon.
W. G. Aspland, Newton Abbot, Devon.
C. Vernon Boys, F.R.S., London.
W. S. Bruce, Leader of Scottish Antarctic Expedition.
T. G. Firth, Belfast.
Professor R. A. Gregory, London.
C. Hawksley, Pres. Inst. C.E., London.
Dr. A. J. Herbertson, Oxford.
Professor W. Libbey, Princeton, New Jersey.
Dr. H. R. Mill, London.
J. Milne, F.R.S., Newport, Isle of Wight.
Dr. W. N. Shaw, F.R.S., London.
J. Smyth, Banbridge, Co. Down.
J. Wilton, of the Scottish Antarctic Expedition.

Before the party separated reference was made to the previous Belfast breakfast in 1874, in which one of those present, Mr. J. Smyth, of Banbridge, who has been a meteorological observer for forty years, had taken part.

Amongst the subjects brought forward for the consideration of local scientific societies at the Conference of Delegates, held on the afternoon of the 17th, was that of starting records of rainfall in conditions which would admit of continuous observations not depending on the life of any one individual; but unfortunately new records are most needed in localities where there are no scientific societies.

The Committee of Recommendations gave a grant of £75 to the committee for making observations in the upper atmosphere by means of kites, and a grant of £50 to the funds of the Scottish Antarctic Expedition, the work of which will be more largely meteorological than that of any of the other south polar expeditions now in the field.

In Section A., Dr. W. N. Shaw, F.R.S., read the following report:—

Investigation of the Upper Atmosphere by Means of Kites in co-operation with a Committee of the Royal Meteorological Society.—Report of the Committee, consisting of Dr. W. N. Shaw (*Chairman*), Mr. D. Archibald, Mr. C. Vernon Boys, Dr. A. Buchan, Mr. W. H. Dines (*Secretary*), *and* Dr. H. R Mill. *Drawn up by the Secretary.*

On the invitation of the Committee appointed by the Royal Meteorological Society, it was decided to hold joint committee meetings, and such meetings were held on October 25th, 1901, January 14th, April 8th, and May 7th, 1902.

The sum of money at the disposal of the joint committee, viz., £75 granted by the British Association and £25 by the Royal Meteorological Society, not being sufficient to meet the necessary expenses, it was decided to apply to the Meteorological Council and to the Government Grant Committee of the Royal Society for further assistance. The Meteorological Council kindly undertook to supply the necessary instruments for a base station, and the Government Grant Committee have made a grant of £75.

Inasmuch as there is considerable risk of damage and also of injury to life should a long wire carrying one or more kites break loose in a thickly populated district, it was decided to make observations in some thinly inhabited part, and, if possible, over the sea, so as to reduce this risk to a minimum. Since, further, we have no information whatever as to the vertical temperature gradient over the great oceans, and this knowledge is of supreme importance for theoretical meteorology, it seemed desirable to work on the west coast, since the prevailing westerly winds must make observations taken there equivalent, as a rule, to those taken over the open sea. It was also thought that if a fair number of observations could be obtained at the height of Ben Nevis, but somewhere on the coast in the neighbourhood of Ben Nevis, some light would be thrown upon the question as to how far the temperatures taken on a mountain summit differ from the temperatures of the free air in the surrounding districts at the same level. With these objects in view I was commissioned to obtain the necessary apparatus and erect it at some convenient spot on the west coast of Scotland.

The apparatus has been obtained and is now (June 17) erected on a small island at Crinan, a small village lying at the north end of the Crinan Canal, about thirty miles south of Oban. The apparatus consists of—

I. The winding-in apparatus, which carries two reels of 16 inches diameter and 4 inches broad, to hold the wire, and two strain-pulleys to reduce the tension of the wire before it is wound. The reels run loose on the same shaft that carries the strain-pulleys, but there is an arrangement by which they are pressed automatically against the strain-pulleys to increase their turning moment by friction against the outer rim of the pulley, or against the fixed frame of the apparatus to reduce the moment. By this means an adjustment of the tension is obtained, and the risk of the reel being crushed by the tension of the many turns of the wire is avoided.

II. *Steam-engine.*—This was obtained from the Reading (U.S.) Road Car Company. It has four single acting cylinders of 2½ inch bore and 4 inch stroke. It weighs about 60 lb. and is nominally of 6 H.P. The cost was £25. The choice lay between a steam-engine and a petrol motor. The steam-engine was chosen for the following reason. It is not desirable to draw in a kite wire when the wire is near the breaking point at a uniform speed, because the speed of winding in is equivalent to an increase of the wind velocity, and greatly adds to the strain. Advantage should be taken of the intervals between the gusts to get in the wire, and this a steam-engine without a dead point does automatically. Winding in a kite during a gale on June 14 the engine acted perfectly, running fast whenever the tension of the wire slackened, and slowing down or even stopping entirely when the tension was increased by a gust. Of course the precise tension at which the engine stops is adjustable within wide limits by adjusting the steam pressure in the boiler. The boiler was obtained from the Britannia Company, Colchester, at a cost of £25. It is fired by ordinary lamp oil (paraffin), of which it uses about a gallon an hour.

III. *The kites.*—These are described in *Symons's Meteorological Magazine* for April, where also the reasons for not using the Blue Hill kite are stated. There are five kites ready for use and the materials for making six or eight more. There are also two kites designed by, and purchased of, Mr. F. S. Cody. Both kinds, so far as my present experience goes, seem entirely satisfactory. Mr. Cody's kite flies at a rather better angle, but does not seem to be quite as

steady as the other. Indeed, the angle of the Cody kite when made of silk and light bamboos is remarkably good.

IV. *The wire.*—This is of the usual kind, but I have been supplied with eight miles in one piece by Messrs. Brunton and Son, Musselburgh, N.B.

V. *Instruments.*—In addition to the well-known Richard instruments, which have been ordered, it seemed desirable to obtain, if possible, something cheaper, since the risk of losing the instruments is not small. I am experimenting with a cheaper form. I also hope to obtain correct determinations of the maximum height and the temperature at that height in the following manner. If a glass tube of uniform bore, sealed at the top, but with the other end under water or quicksilver, were sent up with a kite, it would, assuming constant temperature, give the maximum height, for the air in the tube would expand and bubble out under the decreased pressure, and on the descent water would rise in the tube, and the height of the water or quicksilver would give the minimum pressure, and hence the maximum height. This is assuming constant temperature. But if an exactly similar tube were also used containing saturated vapour of alcohol, two equations would be obtained, from which the two unknown quantities, temperature and height, can be determined. I hope to perfect this method, since there are many occasions on which a kite and a couple of glass tubes might be risked when one would hesitate to send up instruments costing £20.

The apparatus above described is now in use every day when the wind is suitable, but there seem to be very many days during the summer when a sufficiently strong wind does not occur. A velocity of about fifteen miles per hour is necessary, force 4 on the Beaufort scale; but the upper limit at which the kites will fly has not yet been determined.

Addendum by the Chairman, August 22.

Up to August 20 sixty-eight flights have been obtained, as shown in the following table :—

Date.	Time.	Greatest Height.	Temperature Gradient per 1,000 feet.	Wind Direction.		Length of Wire used.	No. of Kites.
				Above.	Below.		
		feet.	° F.			feet.	
June 19	11.50 a.m.	2,840	3·8	S.	E.	5,000	1
,, 20	11.0 ,,	3,300	—	S.E.	S.E.	5,000	1
,, 21	11.0 ,,	3,300	—	S.E.	S.E.	4,515	2
,, 24	11.0 ,,	2,100	5·7	S.S.E.	S.S.E.	—	1
,, 24	7.0 p.m.	2,300	—	S.S.E.	S.S.E.	5,000	1
,, 26	11.0 a.m.	4,600	—	S.S.E.	S.E.	7,500	1
July 1	11.0 ,,	1,850	—	N. by E.	N.N.W.	3,000	1
,, 3	12.45 p.m.	2,500	4·5	N. by E.	S.S.W.	4,000	1
,, 4	7.0 ,,	2,250	3·0	N.N.W.	N.N.W.	3,560	1*
,, 7	11.0 a.m.	4,600	2·2	W.	W.	7,330	1*
,, 8	11.0 ,,	2,000	1·8	—	S.S.E.	—	1*
,, 9	12.0 n.	4,950	3·3	S.W.	S.W.	9,000	2*
,, 9	6.10 p.m.	2,300	3·9	—	W.	4,000	1
,, 10	4.0 ,,	4,040	2·3	N.N.W.	N.W.	7,000	1
,, 11	12.30 ,,	1,800	—	—	—	—	1
,, 11	6.50 ,,	1,350	0·8	—	W.	2,300	1
,, 12	5.0 ,,	1,300	1·5	—	S.W.	—	1*
,, 14	6.0 ,,	1,950	—	S.W. by W.	S.S.W.	—	1

Date.	Time.	Greatest Height.	Temperature Gradient per 1,000 feet.	Wind Direction.		Length of Wire used.	No. of Kites.
				Above.	Below.		
		feet.	° F.			feet.	
July 15	11.0 a.m.	6,400	3·1	S.W.byW.	S.W.	10,300	2*
,, 15	5.0 p.m.	4,300	2·8	S.W.	S.W.	—	1*
,, 16	12.5 ,,	6,000	2·0	W.S.W.	S.W.	10,300	2*
,, 17	11.45 a.m.	3,160	2·9	—	W.	—	1*
,, 17	5.30 p.m.	3,600	3·3	N.N.W.	N.W.	—	1*
,, 18	1.0 ,,	5,000	3·6	N.N.W.	N.W.	—	2*
,, 19	6.55 ,,	3,400	2·6	N.N.W.	N.W.	6,000	1
,, 21	11.0 a.m.	1,170	4·3	N.N.W.	N.N.W.	—	1
,, 21	7.55 p.m.	3,000	2·7	N.W.	W.	6,200	2*
,, 22	4.45 ,,	1,330	—	N.N.W.	W.	—	1
,, 23	10.40 a.m.	1,750	3·4	N.N.W.	N.W.	—	1
,, 23	6.45 p.m.	2,230	—	N.W.	N.W.	3,225	1
,, 24	11.45 a.m.	4,000	4·2	N.	N.N.W.	7,000	2
,, 24	5.20 p.m.	4,760	3·6	N.W.	W.N.W.	10,600	2*
,, 25	11.0 a.m.	2,450	—	—	W.	4,200	1
,, 25	7.30 p.m.	1,320	—	—	N.W.	2,020	—
,, 26	11.0 a.m.	4,330	3·5	E.	E.N.E.	5,450	1*
,, 26	7.0 p.m.	5,500	2·3	E.N.E.	N.E.	10,200	2*
,, 28	12.0 n.	7,350	3·3	S.W.byW.	W.S.W.	12,000	2
,, 28	7.30 p.m.	5,000	2·5	S.S.W.	S.S.W.	8,100	1*
,, 29	12.30 ,,	4,325	2·7	W.	W. by S.	8,200	1*
,, 29	7.40 ,,	5,330	3·1	W.	W.S.W.	8,412	1*
,, 30	12.10 ,,	8,950	2·7	N.N.W.	N.W.	17,300	2*
,, 31	11.0 a.m.	1,560	3·6	—	N.N.W.	—	1*
,, 31	6.20 p.m.	1,550	—	—	W.	—	1
Aug. 1	11.0 a.m.	2,400	4·1	W.S.W.	S. by W.	—	1
,, 1	7.30 p.m.	8,550	1·7	W.S.W.	S.S.W.	16,000	2*
,, 2	11.30 a.m.	8,370	2·1	S.W.byW.	S.W.	13,500	2*
,, 2	5.10 p.m.	4,900	2·5	—	S.W.byW.	7,530	1*
,, 4	4.0 ,,	1,520	—	—	W.	—	1
,, 5	11.30 a.m.	1,840	—	—	E.	—	1
,, 6	1.30 p.m.	3,800	3·5	E.S.E.	E.	6,900	1*
,, 7	11.0 a.m.	2,725	5·0	E.N.E.	N.E.	4,300	1
,, 8	11.40 ,,	1,300	4·0	—	N.N.W.	—	1
,, 8	5.20 p.m.	6,900	3·5	N.W.	W.N.W.	12,000	2*
,, 9	11.0 a.m.	2,360	3·7	—	W.N.W.	—	1
,, 9	4.40 p.m.	7,175	3·1	N.W.	W.N.W.	13,000	2*
,, 11	1.20 ,,	7,425	2·4	N.W.	N.W.byW.	18,000	3*
,, 12	10.10 a.m.	4,080	3·5	N. by W.	N.W.	7,375	1
,, 12	4.15 p.m.	1,550	1·5	—	W.S.W.	2,900	1*
,, 13	3.0 ,,	1,350	3·0	S.E.	S.	—	1
,, 14	4.30 ,,	1,950	1·8	W.	W.	—	1
,, 15	11.30 a.m.	2,300	3·9	S.W.	W.	3,900	1
,, 15	6.30 p.m.	1,415	—	S.W.	W.	2,500	1
,, 16	11.30 a.m.	1,400	1·8	N.N.W.	N.W.	2,190	1
,, 18	2.30 p.m.	2,750	4·3	N.N.W.	N.	4,980	2
,, 19	11.10 a.m.	4,250	3·9	N.N.W.	N.W.	7,100	2
,, 19	3.30 p.m.	4,400	3·8	W.N.W.	N.W.	9,537	2*
,, 20	12.10 ,,	11,450	2·4	N.W.	N.W.	21,350	3*
,, 20	7.20 ,,	4,000	4·5	W.N.W.	W.	7,100	1

In the cases marked * records from Richard instruments were obtained, in the others the temperature at the highest point only.

For the period extending from July 8 to August 22 a steam-tug was obtained, and the apparatus mounted on the deck. This arrangement was found to give much more effective control over the experiments, and rendered possible observations in light winds that would not have lifted the kites on land.

The observations will be discussed, and the results prepared for publication in the course of the ensuing year. The Committee consider that the work that has been completed is amply sufficient to show that the apparatus and methods are effective for securing valuable information as to the upper air in various conditions of weather. There are some points in which it seems desirable to attempt to improve the recording apparatus in order that the readings may be more definitely checked, and the Committee think it desirable for the experiments to be continued for another year, during which it may be possible to arrange the flights to obtain precise information regarding the distribution of temperature and humidity in specific conditions of weather in order to examine the physical processes taking place in the upper air corresponding to weather changes noted at the surface.

Dr. H. R. Mill read the following extracts from a letter just received from Mr. Dines, giving particulars of the observations made during the last few days of the experiments at Crinan.

"The kite ascents, of which particulars were not sent for the report, were 12,000 feet with 3 kites on Saturday, August 23rd, and 8,600 feet with 3 kites on Monday, August 25th, in both cases there are good records. On August 26th, a height of about 14,500 feet was reached; on this occasion the instruments were lost, and as the furthest kite of the four used could not be located by the sextant, being hardly visible, the height is uncertain; but it was certainly somewhere between 14,000 and 15,000 feet.

"The total result of the experiments is 71 ascents, with an average height of 4,040 feet. For 38 of these there are automatic records, and the remainder were mostly low ascents on days when the wind was too light to raise the instruments; but the temperature at the highest point was obtained."

Mr. C. Vernon Boys expressed the gratitude of the meeting to Mr. Dines for the manner in which he had carried out the experiments, and congratulated him on his good fortune in not losing the instruments before what was in any case to be the final ascent of the series.

On the motion of the Chairman, Professor Schuster, a vote of thanks was passed to Mr. Dines and to the Committee.

The Rainfall of Ireland. *By* HUGH ROBERT MILL, D.Sc., LL.D. (*Read in Section* G.)

In order to determine the true mean annual rainfall of any region it is necessary to have uniform, continuous, and prolonged observations at a large number of well-distributed stations.

It is now possible for the first time to give a fairly satisfactory account of Irish rainfall, though the observing stations at work are only one for every 170 square miles, as compared with one for every 20 square miles in England. The number of stations in Ireland has increased from 83 in 1874, to 190 in 1901, an increase of 140 per cent.; while the number of stations in England and Wales increased only by 120 per cent., and in Scotland only by 32 per cent. in the same period. In 1874 there was not a single record of rainfall from

the counties of Clare, Kildare, Leitrim, Limerick, Longford, or Monaghan; now there is at least one rain record from every county. The number of stations whose readings are quoted in "British Rainfall" is still far too small, especially in Connaught, and after the stimulus of the British Association in Belfast produced its effect in 1875, the number in Ulster has ceased to grow.

Province.	Rain stations. No. in 1874.	No. in 1875.	No. in 1901.
Ulster	30	55	56
Connaught	10	15	22
Leinster	26	31	62
Munster	17	28	50
Ireland	83	129	190

While 1,400 additional stations would be necessary to place Ireland on the same footing as England per unit of area, only 185 additional observers are required to give the same number of rain gauges per thousand of population, but even this means practically doubling the number of observing stations.

Perfect records for the ten years 1890-99 exist for 108 stations in Ireland, and by computation 31 additional records can be made available. Of these, 20 records are perfect for the thirty years 1870-99, and 57 records of somewhat shorter duration can be computed with reasonable accuracy. The distribution is not satisfactory, the western half of the country and all the mountainous districts being very poorly represented. Maps have been constructed, however, which give a more complete representation of Irish rainfall than anything previously compiled.

The map for the thirty years 1870-99 may be taken as showing the true mean fall as far as the limited number of stations makes it possible to do so. There are only three small areas with a fall exceeding 50 inches per annum—in the west of Kerry, of Mayo, and Donegal respectively. Possibly some parts of the eastern mountains may also have a fall exceeding 50 inches. More than 40 inches fall over the whole of Ireland west of the Foyle and the Shannon, and to the west and south of a line drawn from Limerick through Mallow to Clonmel, whence a narrow belt equally wet runs north-eastward through the counties of Waterford, Wexford and Wicklow. Two small areas with more than 40 inches occur in the mountains of the south-east of co. Down and the east of co. Antrim. All the rest of Ireland has between 30 and 40 inches of rain, except parts of co. Dublin and co. Meath, where the fall averages a little less than 30 inches. The following table gives a rough approximation to the areas of the different zones of rainfall:—

Under 30 inches	(average 29 in.)	600 sq. miles.
From 30 to 40 inches ...	(,, 35·5 ,,)	13,200 ,,
,, 40 ,, 50 ,, ...	(,, 44 ,,)	13,600 ,,
Above 50 inches	(,, 60 ,,)	4,400 ,,
		31,800 ,,

This gives an average of 42 inches for the whole country, but the figure is by no means certain.

The variations of rainfall in Ireland are less than those in England. Thus, for the ten years 1890-99 the rainfall over Ireland was only 2 per cent. below

the 30 years' average; that over England and Wales showed a deficiency of 7 per cent. The average rainfall of the 10 years was practically the same as that of the thirty years in central Ireland; a trifle above the average in the north-west, and a little below the average round the north, east and south coasts.

It is to be hoped that existing rainfall stations will be kept up and new ones established in all parts of the country, so that there may be a basis for the accurate measurement of the average quantity of water available for inland navigation, town supply and for power.

This paper was discussed in conjunction with a paper by Mr. F. T. Dick on the Available Water-power of the Principal Rivers of Ireland, especially the Shannon, Erne and Bann. Mr. Dick was of opinion that an exaggerated idea as to the amount of power to be obtained from the rivers had got abroad. This was confirmed by several speakers, but energetically combatted by others.

Mr. J. Smyth, of Banbridge, referred to the numerous water-power installations on the Upper Bann where many turbines were now in use. As an old rainfall observer, he hoped that more rain gauges would be started, especially at high stations.

Professor Unwin considered that more local knowledge as to the water-power of Ireland was required, and hoped that Government might be induced to facilitate a complete investigation of the available power.

Sir William Preece, F.R.S., congratulated Dr. Mill on his paper, which supplied data of the greatest value, and said that given the rainfall on a river-basin and the fall of the land, it was the easiest thing in the world to calculate the resulting water-power. As to the utilization of the power, it was simply a matter of relative expense, and even although the Irish rivers might not be able to supply distant towns with all the power required for lighting and tramways, he agreed with Professor M. FitzGerald that they might well be capable of supplying electric energy to small factories in the vicinity of the stream, and so be extremely useful.

Mr. Charles Hawksley, President of the Institution of Civil Engineers, drew attention to the importance of comparing the rainfall of longer and shorter periods as was done on the maps exhibited; and pointed out that the rivers were approached by the public from many different motives—they were required for water-supply, for navigation, for drainage, for the production of power, and finally for fisheries, an object to which it was too much the habit to sacrifice the other and more important uses.

(*To be continued.*)

THE MAIDSTONE HAILSTORM OF SEPTEMBER 10TH.

A VIOLENT thunderstorm, accompanied by heavy rain and exceptionally severe hail, caused much damage in the district between Maidstone and Tonbridge, on the afternoon of Wednesday, 10th September. Similar storms occurred, though less intensely, in other parts of the country, on the same afternoon, the areas affected being small in every case, so that falls of between 1·50 in. and 2·00 in. are reported at Maidstone, Wallington, and Pyrford, while no rain at all, or less than ·10 in., was observed at intervening stations.

The main feature of the storm at Maidstone was the size and amount of the hail, which, coming at the time when hop-picking was at its height, did great damage, entirely destroying the hop-crop in some gardens, and causing much discomfort to the hop-pickers. The following extracts from correspondence and from the press show that the visitation was of no ordinary kind.

To the Editor of Symons's Meteorological Magazine.

In the course of three-quarters of an hour, judging from reports, during a violent storm of rain, hail, thunder and lightning, this afternoon, 1·65 in. of rain fell. I was on Bidborough Hill, near Southborough, at the time, and there there was very little rain. Going down to Tonbridge we began to see signs of a heavier fall, and about 5.30 p.m. we saw from Paddock Wood a very thick white mist rising from the fields, which were white with hail, and water was lying on the land. The storm was very severe at East Farleigh, where 2·00 in. is said to have been measured by the gauge at the waterworks. Here a whole field of hops was prostrate, including the large outside poles, while the soil was washed out into the road, and into the school and church. No one remembers such a storm before.

T. W. CARR.

Long Rede, Barming, Maidstone,
10th September, 1902.

I forward a newspaper containing particulars of the storm in the Maidstone district on 10th. To me the great interest of this storm lies in the size of the hailstones, and in the quantity that fell.

The storm was at its worst between 3 and 4 p.m. At 8 p.m. I had to drive through a part of the district which had been very severely visited, and I am not exaggerating when I say that at certain parts of the road the hail lay in masses to the depth of a foot and more, and impeded our progress, and this despite the fact that the temperature did not seem to have perceptibly fallen, though there was a dense fog. Yesterday, three days after the storm, I saw hailstones from the garden of a friend at Wateringbury still measuring half-an-inch in diameter.

JAMES W. NORTH.

Maidstone, 14*th September*, 1902.

From the "Kent Messenger," 13*th September*, 1902.

"Our Wateringbury correspondent writes: At about 2.45 p.m. a thunderstorm came up from the westward and broke over the village. The thunder and lightning were very severe, and at the commencement of the storm the rain was fairly heavy, but it was not until about three o'clock that the worst began, and then it commenced to hail, at first moderately and with stones

about the size of peas. Then it suddenly changed to enormous hailstones, many of which were at least two inches through, some even larger, and any amount of the size of large walnuts. During the worst of the storm it was absolutely dangerous to life to be out of shelter. Windows were broken in hundreds, in some cases almost every pane of glass being smashed in one window. Glass houses suffered severely. The hop gardens and orchards also have suffered an enormous amount of damage. Incredible as it may seem, hop gardens in some instances are literally stripped bare, scarcely a hop or a leaf being left. Apples were washed down the roads in the torrents of water; even piles of stones for repairing roads were washed completely away from their depôts."

The following casualties from lightning are reported in the same paper:—

Two men were struck in a hop-garden at Hunton, and one, named Charles Reed, age 21, was killed.

Two houses were struck in Maidstone, in one a gas-pipe was melted, and the gas set on fire.

At Mereworth a horse was killed, and a stack of wheat set on fire by lightning. The stack is said to have been insured only a few hours before.

At Hadlow Grange a man was struck, but not seriously injured, and at Hildenborough a bullock was killed.

Correspondence.

THE MOON AND RAINFALL.

To the Editor of Symons's Meteorological Magazine.

I am afraid that Mr. Mac Dowall, in his letter in your August number, to some extent misunderstands me. I do not say that we should publish only what is exhaustive, but rather that a good deal that appears hardly tends to edification. The measure of the value of a paper is the quality of the work put into it, be it lengthy or brief.

Mr. Mac Dowall considers that a man 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?" Undoubtedly he may. But the results given in Mr. Mac Dowall's papers are too often far from striking, or likely to encourage others to pursue his lead. Moreover, in his paper on "The Moon and Rainfall," they were, to those conversant with questions of the kind, distinctly suggestive of what was misleading, and it was to remove the impression created that I undertook to extend Mr. Mac Dowall's inquiry to include a period of forty years, with result as stated, that it has yet to be shown that the moon has anything to do with the

variations of rainfall therein found to exist. A further point is that Mr. Mac Dowall frequently fails to give sufficient indication of the source from which the material he employs is obtained, and so makes difficult any direct confirmation of his work by others. I am not denying lunar influence, but only ask that it shall be satisfactorily proved to exist. As regards M. Dechevrens having brought before a French society the relation of a single year's rainfall to lunar phases, any such comparison can have no real value, as regards proof of connection between the two classes of phenomena.

I would further refer to two other of Mr. Mac Dowall's papers: to one on "Sunspots and Air Temperature," given at page 118 of Vol. **28** of your Magazine, and to my remarks thereon at pages 22 and 88 respectively of your following Vol. **29**. The other is to be found in the "Quarterly Journal of the Royal Meteorological Society," page 243 of Vol. **23**, under the title "Suggestions of Sunspot Influence on the Weather of Western Europe," my remarks in this case appearing in the discussion that followed the reading of the paper, with the appearance of which in the Quarterly Journal I had nothing to do.

We can all admire the efforts of one who has shown so considerable an industry, and hope to see him yet produce some valuable work. I cannot, however, help expressing regret at the tone of parts of Mr. Mac Dowall's last letter, which seems, I think, somewhat out of place. I may add that, as respects the present discussion, this is my last word.

WILLIAM ELLIS.

Blackheath, September 15th, 1902.

THE METEOR OF JULY 13TH.

To the Editor of Symons's Meteorological Magazine.

Standing in my garden facing S.W., I saw on my left a sudden flash of intensely bright white light casting a strong shadow. Immediately turning round, I saw the meteor as a ball of light disappearing behind a tree and leaving a trail which simultaneously became sinuous, changed from nearly white through red to violet, and resolved itself into a chain of separate points of light or "stars," and on their fading away the impression was left on the retina (perhaps an illusion) of a dark line in the sky.

The time was between 10.30 and 10.31 p.m., the direction S.E., the trail passed through an angle of from 50° or 55° to 40° with the horizon and inclined to the right or S. about 10° or 12° with the vertical, and it was visible for from 5 to 10 seconds as nearly as I can estimate.

JOHN HOPKINSON.

Weetwood, Watford.

THE CLIMATE OF PEMBA IN 1901.

MR. THEODORE BURTT has favoured us with his meteorological observations for 1901 at Banani, in the island of Pemba, on the East Coast of Africa, one of the least known of British possessions. We published his records for 1899 and 1900 in our number for April, 1901.

With regard to 1901, Mr. Burtt says:—"There has been more cloud than usual, and the rainfall has been better distributed over the year than in 1899 or 1900. This has somewhat reduced the mean and the maximum temperatures, but has not affected the minimum."

It is impossible to praise too highly the perseverance of an observer who keeps a regular record in so trying a climate as that of Pemba, and we would like to see the good example largely followed in other parts of Africa.

Meteorological Observations taken at Banani, Island of Pemba, East Africa.

1901.	Mean Max.	Mean Min.	Absolute Max.	Absolute Min.	Rainfall.	Rainy Days.
	°	°	°	°	in.	
January	84·6	73·8	90·0	70·0	4·00	13
February	82·5	71·9	85·0	68·0	12·09	13
March	85·8	74·2	90·5	72·5	6·54	12
April	81·9	70·6	87·0	70·0	20·79	23
May	80·2	70·0	84·0	68·0	27·40	25
June	78·9	68·1	83·0	66·0	3·23	16
July	78·5	67·1	80·0	66·0	3·06	14
August	79·2	67·3	82·0	66·0	·93	11
September	80·5	67·4	83·0	65·0	·90	5
October	83·2	69·5	86·0	67·0	2·73	8
November	82·9	71·5	87·0	70·0	7·50	13
December	83·5	73·0	87·0	71·0	3·61	13
Year	81·8	70·4	90·5	65·0	92·78	166

Highest temperature in sun ... ... 175°.

Years.	Mean Max.	Mean Min.	Absolute Max.	Absolute Min.	Rainfall.	Rainy Days.
	°	°	°	°	in.	
1899	83·3	70·2	92·0	65·0	105·24	149
1900	83·5	71·3	95·0	66·0	90·35	160
1901	81·8	70·4	90·5	65·0	92·78	166

ERRATUM.

In the September number, p. 118, line 8 from bottom, *in place of* 1·15 in. *read* 1·51 in.

REVIEWS.

Report of the Kodaikanal and Madras Observatories for the period 1st April to 31st December, 1901. [By C. MICHIE SMITH.] Size 13 × 8½. Pp. 22.

THESE observatories are under the Observatories Committee of the Royal Society; that at Kodaikanal a hill-station in the Madras presidency has recently been completed, and is largely devoted to solar physics and meteorology. The current report refers to nine months only, as a change is being made from the official to the more convenient calendar year. We are now publishing monthly returns from both observatories in the table of Climatology of the British Empire.

Der Ozean. Eine Einführung in die allgemeine Meereskunde. Von DR. OTTO KRÜMMEL. Zweite Auflage. Leipzig, G. Freytag, 1902. Size 7½ × 5½. Pp. viii.+286.

IT is curious that although British men of science have done more for the study of the ocean than those of any other nationality, there is no book in the English language dealing with the science of oceanography as a whole. We have been so frequently asked to recommend a good and simple book on the science of the sea that it gives us great pleasure to see the new edition of Professor Krümmel's excellent little work. It contains all that the general reader need wish to know on the subject of the oceans, the mode in which they are investigated, the conditions and movements of their waters; and to those who find the German language no bar to their enjoyment of a piece of real scientific literature, we most cordially commend it. The facts are up to date, the illustrations are well selected, and the index is of great value.

The Circulation of the Atmosphere in the Tropical and Equatorial Regions. By A. LAWRENCE ROTCH. Reprinted from the *Monthly Weather Review* for April, 1902. Size 9 × 6. Pp. 4. Plates.

THIS paper gives the views of Mr. Rotch and Professor Hildebrandsson on various theories of atmospheric circulation, a summary of the ascertained facts, and a scheme for new and direct observations on the upper atmosphere in the tropics by means of kites or balloons.

Informe que . . . Ing. Manuel E. Pastrana rinde . . . sobre las observaciones ejecutadas durante el eclipse total de Sol de 28 de Mayo de 1900. [Report presented by M. E. PASTRANA on the observations made during the total solar eclipse of May 28, 1900.] Mexico, 1901. Size 9½ × 7. Text, 192 pp., and Atlas of 42 plates.

THE Director of the Mexican Meteorological Office treats in great detail of the observations of atmospheric conditions at different

stations in the republic of Mexico during the eclipse of the sun in 1900, but it is a great pity that so much good work should be set forth without a table of contents, an index, or any help to obtain a general idea of the nature of the work. To most men of science the reading of Spanish is a toil that demands every mitigation if it is to be attempted.

BOOKS RECEIVED.

The Cyclone of 1901, January 9-16. By T. F. Claxton, F.R.A.S. *Proc. Met. Soc. Mauritius.* 1901. Size 8½ × 6. Pp. 22.

Climatologie du Littoral roumain de la Mer Noire par le Dr. Stefan C. Hepites. Liége, 1901. Size 10 × 6. Pp. 28.

Climatologia Bucaresciana. Anul, 1898 and 1899. de Stefan C. Hepites. Bucaresci, 1901. Size 11 × 8. Pp. 38 and 32.

Totland Bay, Isle of Wight. Report of Meteorological Observations for the Year 1901. Second year of issue. By John Dover, M.A., F.R.Met.Soc. Newport, 1902. Size 9½ × 6. Pp. 16. Price 1s.

Borough of Hastings. Annual Report of Meteorological Observations for the Year 1901. Published by the authority of the Corporation. H. Colborne, M.R.C.S., Borough Meteorologist. St. Leonards, 1902. Size 9½ × 6. Pp. 16.

Nedböriagttagelser i Norge [Rainfall in Norway]. Aargang VII. 1901. One map and two plates. Christiania, 1902. Size 16 × 11. Pp. 125. [We believe this to be the only national record of rainfall in the world which is published at an earlier date than *British Rainfall.* We congratulate Professor Mohn on his prompitude and on the accurate nature of his report].

Ergebnisse der Beobachtungen an den Stationen II. und III. Ordnung im Jahre 1897, zugleich Deutsches Meteorologisches Jahrbuch für 1897. One map. Heft III., 1897. Von V. Kremser. Berlin, 1902. Size 13 × 10. Pp. 372.

Bericht über die Thätigkeit im Königlich sächsischen meteorologischen Institutes für das Jahr 1898. Four plates. XVI. Jahrgang, 1898. Von Prof. Dr. Paul Schreiber. Chemnitz, 1902. 12 × 10. Pp. 80 and Index.

METEOROLOGICAL NEWS AND NOTES.

THE POSITION OF METEOROLOGY IN AMERICA is the theme of Professor Cleveland Abbe in the June number of the *North American Review*, and he claims that the United States has led the way in scientific meteorology, and maintained its lead through the wide scope of the Weather Bureau and the enlightened administration of its Director, Professor Willis L. Moore. With regard to research, Professor Abbe says:—

"The gift for research is a style of intellectual energy that refuses to be bound by regulations. An energetic investigator, immured in the walls of a great organization, may be as much out of place as a wild bird in a cage. He must have intellectual freedom. He can utilize, but must not be dominated by, his surroundings.

"It is the object of the Weather Bureau to profit by the services of men of this character, and give them opportunities for research."

WOLFE'S SUNSPOT NUMBERS for each month from January, 1749, to December, 1901, revised in March, 1902, and published in the *Monthly Weather Review* for April, will be found very useful by all those whose attention is turned to the possibility of establishing a relationship between solar periodicity and terrestrial atmospheric recurrences. The observed values of sunspot frequency are given in figures and in a curve through which a smoothed curve is drawn and this in turn reduced to figures.

THE INTERNATIONAL METEOROLOGICAL COMMITTEE will hold its next meeting at Southport during the meeting of the British Association in that town in September, 1903. We understand that an effort will be made to allow the distinguished continental meteorologists who will be present to see that the science of meteorology is being actively advanced in this country.

A RAINFALL MAP OF BULGARIA, compiled by Dr. C. Kassner from the observations of 102 stations, most of them for the nine years 1893—1901 appears in Petermanns Mitteilungen for July. The period is certainly a short one from which to deduce the mean distribution of rainfall over a country; but the author shows that at the not very distant station of Bukharest, in Rumania, the ten years 1891—1900 had the same mean fall as the thirty years 1871—1900, hence it is reasonable to assume that the period available for Bulgaria was probably a normal one. The isohyets on the map are, however, drawn partly from theoretical considerations, especially in the mountainous regions.

DEW BOWS form the subject of an article in *Science* for September 19th. Mr. Lyman J. Briggs describes a bow resembling a small rainbow but formed by the drops of dew which tipped the blades of a field of very short young grass of uniform height.

THE INTERNATIONAL AERONAUTICAL CONGRESS at Berlin in May is described by Mr. A. Lawrence Rotch in a recent number of *Science*. A large part of the time of the Congress was devoted to meteorological kite-flying and the use of unmanned balloons; one of the latter liberated during the Congress brought back a record from the unprecedented height of 65,500 feet, or nearly $12\frac{1}{2}$ miles. Mr. Rotch announced that he had applied to the Carnegie Institution (recently founded in the United States) for £2000 towards the expense of a special expedition to explore the upper atmosphere in the trade-wind regions by means of kites. The British Government was represented at the Congress, which augurs well for the future of these important researches in this country.

MR. MAXWELL HALL, who has for many years carried out the heavy task of collecting records of the rainfall and other meteorological elements of Jamaica, has retired from the work, which has been transferred to the Board of Agriculture of the Colony and is being continued by Mr. H. H. Cousins.

SEPTEMBER, 1902.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·00	— 1·07	·41	10	9	76·0	22	38·3	19	0	0
II.		Tenterden ...	1·64	— ·75	1·18	2	13	71·5	7	37·0	19	0	1
,,		Hartley Wintney ...	·50	— 1·70	·14	11	10	72·0	1	31·0	19*a*	2	7
III.		Hitchin ...	1·87	— ·26	1·33	11	9	70·0	22	35·0	29	0	...
,,		Winslow (Addington) ...	1·81	— ·45	1·32	10	9	75·0	22	32·0	19	1	2
IV.		Bury St. Edmunds (Westley)	·69	— 1·80	·32	11	7	73·0	7	36·5	13	0	...
,,		Norwich (Brundall) ...	1·38	— 1·07	·66	2	8	73·0	3	38·0	19	0	0
V.		Winterborne Steepleton ...	1·86	...	·56	2	14	69·7	8	33·4	19	0	5
,,		Torquay ...	2·46	...	·80	22	11	68·4	1	43·9	19	0	0
,,		Polapit Tamar [Launceston]..	2·95	— ·35	·91	22	18	71·2	21	30·6	19	1	3
VI.		Stroud (Upfield) ...	2·73	+ ·29	1·21	10	14	71·0	2, 4	40·0	29	0	...
,,		Church Stretton (Woolstaston)	1·93	— ·48	·46	10	17	68·5	1	37·5	13	0	...
,,		Worcester (Diglis Lock) ...	1·12	— ·70	·54	10	11	...	...	...	...	...	...
VII.		Boston ...	1·46	— ·52	·48	11	11	74·0	1	40·0	19	0	...
,,		Hesley Hall [Tickhill]...	·62	— 1·27	·38	10	11	75·0	8	32·0	24	1	...
,,		Derby (Midland Railway)...	1·66	— ·35	·59	10	15	75·0	1, 8	37·0	13	0	...
VIII.		Manchester (Plymouth Grove)	·99	— 2·18	·23	17	17	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ...	·88	— 1·34	·23	22	13	...	...	...	...	...	...
,,		Skipton (Arncliffe) ...	2·59	— 2·59	·70	15	16	...	...	...	...	...	...
,,		Hull (Pearson Park).	·69	— 1·54	·26	10	12	72·0	6	35·0	13	0	1
X.		Newcastle (Town Moor) ...	·61	— 1·57	·11	12	12	...	...	...	...	...	...
,,		Borrowdale (Seathwaite)...	5·84	— 7·04	1·93	15	16	73·2	8	34·6	29	0	...
XI.	WALES.	Cardiff (Ely) ...	2·67	— 1·08	·77	23	14	...	...	...	...	...	...
,,		Haverfordwest ...	3·85	+ ·05	·93	2	16	70·9	8	34·1	19	0	8
,,		Aberystwith (Gogerddan) ...	1·68	— 2·39	·52	23	12	75·0	8	27·0	18	4	...
,,		Llandudno...	1·40	— 1·47	·33	23	15	74·0	2	39·5	29	0	...
XII.	SCOTLAND.	Cargen [Dumfries] ...	2·61	— 1·14	·80	2	12	71·0	8	30·0	13	1	...
XIII.		Edinburgh (Royal Observatory)	1·40	...	·34	3	12	67·2	8	35·7	13	0	2
XIV.		Colmonell ...	4·50	+ ·51	1·11	2	14	72·0	7, 8	31·0	12	1	...
XV.		Tighnabruaich ...	6·81	...	1·32	20	18	63·0	9	34·0	12	0	...
,,		Mull (Quinish)...	6·72	+ 1·60	1·16	2	19	...	...	...	...	...	...
XVI.		Loch Leven Sluices ...	1·94	— ·97	·41	3	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	1·45	— ·78	·40	2	16	70·9	8	36·6	13	0	...
XVII.		Braemar	2·06	— 1·06	·61	2	17	67·2	8	32·6	19	0	2
,,		Aberdeen (Cranford)	1·52	— 1·21	·57	22	21	71·0	6	35·0	24	0	...
,,		Cawdor (Budgate) ...	1·69	— 1·40	·31	2	21	...	...	...	...	...	...
XVIII		Strathconan [Beauly] ...	3·13	— 1·35	1·00	3	9	...	...	...	...	...	...
,,		Glencarron Lodge...	...	...	...	...	...	...	...	...	...	...	...
XIX.		Dunrobin ...	1·85	— ·74	·68	2	13	62·0	6	36·0	19	0	...
,,		S. Ronaldshay (Roeberry) ...	2·13	— 1·34	·43	3	17	62·0	6	39·0	12	0	...
XX.	IRELAND.	Darrynane Abbey...	2·31	— 1·86	·55	21	18	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	5·02	+ 1·89	2·25	2	11	68·5	7	34·0	18	0	...
,,		Broadford (Hurdlestown) ...	2·19	— ·68	·62	2	17	68·0	3	38·0	12	0	...
XXI.		Carlow (Browne's Hill) ...	3·97	+ 1·24	2·32	2	14	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·97	+ ·85	2·08	2	16	69·0	22	41·6	18	0	0
XXII.		Ballinasloe	1·75	— 1·39	·72	2	17	68·5	6	32·0	13	1	...
,,		Clifden (Kylemore)	4·25	— 2·59	1·29	22	13	...	...	...	...	...	...
XXIII		Seaforde...	5·46	+ 2·31	2·64	2	15	70·0	6, 8	37·0	17	0	...
,,		Londonderry (Creggan Res.).	3·74	— ·13	·74	1	20	...	...	...	...	...	...
,,		Omagh (Edenfel) ...	3·20	— ·51	·90	2	19	69·0	8	34·0	17	0	1

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

a—and 26.

SUPPLEMENTARY TABLE OF RAINFALL, SEPTEMBER, 1902.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	1·00	XI.	Castle Malgwyn	2·73
II.	Dorking, Abinger Hall .	·83	,,	Builth, Abergwesyn Vic.	...
,,	Sheppey, Leysdown	·90	,,	Rhayader, Nantgwillt ...	3·37
,,	Hailsham	·84	,,	Lake Vyrnwy	1·99
,,	Crowborough.....	·49	,,	Ruthin, Plâs Drâw	1·14
,,	Ryde, Beldornie Tower..	...	,,	Criccieth, Talarvor	1·46
,,	Emsworth, Redlands ...	·99	,,	I. of Anglesey, Lligwy..	1·78
,,	Alton, Ashdell	1·03	,,	Douglas, Woodville.....	3·44
,,	Newbury, Welford Park	2·07	XII.	Stoneykirk, Ardwell Ho.	4·22
III.	Oxford, Magdalen Coll..	1·07	,,	Dalry, Old Garroch	4·85
,,	Banbury, Bloxham	1·80	,,	Moniaive, Maxwelton Ho.	3·35
,,	Pitsford, Sedgebrook ...	1·22	,,	Lilliesleaf, Riddell	2·00
,,	Huntingdon, Brampton.	1·28	XIII.	N. Esk Res. [Penicuick]	2·25
,,	Wisbech, Bank House...	1·30	XIV.	Glasgow, Queen's Park..	3·56
IV.	Southend	1·30	XV.	Inveraray, Newtown ...	5·13
,,	Colchester, Lexden	1·47	,,	Ballachulish, Ardsheal...	5·93
,,	Saffron Waldon, Newport	·75	,,	Islay, Eallabus.....	7·18
,,	Rendlesham Hall	1·31	XVI.	Dollar.....	2·08
,,	Swaffham	1·04	,,	Balquhidder, Stronvar...	5·33
V.	Salisbury, Alderbury ...	1·17	,,	Coupar Angus Station...	1·83
,,	Bishop's Cannings	1·57	,,	Blair Atholl	2·60
,,	Blandford, Whatcombe .	...	,,	Montrose, Sunnyside ...	1·83
,,	Ashburton, Druid House	3·38	XVII.	Keith H.R.S.....	2·29
,,	Okehampton, Oaklands.	2·40	XVIII.	Fearn, Lower Pitkerrie..	1·81
,,	Hartland Abbey	3·04	,,	S. Uist, Askernish	...
,,	Lynmouth, Rock House	2·64	,,	Invergarry.....	2·76
,,	Probus, Lamellyn	3·15	,,	Aviemore, Alvie Manse.	1·65
,,	Wellington, The Avenue	2·41	,,	Loch Ness, Drumnadrochit	1·65
,,	North Cadbury Rectory	1·24	XIX.	Invershin	2·37
VI.	Clifton, Pembroke Road	2·12	,,	Bettyhill	2·31
,,	Ross, The Graig	1·83	,,	Watten H.R.S.....	2·07
,,	Shifnal, Hatton Grange	1·27	XX.	Dunmanway, Coolkelure	...
,,	Wem, Clive Vicarage ...	1·24	,,	Cork, Wellesley Terrace	2·02
,,	Cheadle, The Heath Ho.	1·89	,,	Killarney, District Asyl.	1·84
,,	Coventry, Priory Row ..	1·25	,,	Caher, Duneske	...
VII.	Market Overton	1·71	,,	Ballingarry, Hazelfort...	2·19
,,	Grantham, Stainby	1·24	,,	Miltown Malbay	...
,,	Horncastle, Bucknall ...	·73	XXI.	Gorey, Courtown House	3·16
,,	Worksop, Hodsck Priory	1·05	,,	Moynalty, Westland ...	2·31
VIII.	Neston, Hinderton	·83	,,	Athlone, Twyford	2·20
,,	Southport, Hesketh Park	·97	,,	Mullingar, Belvedere ...	2·39
,,	Chatburn, Middlewood.	1·01	XXII.	Woodlawn	1·80
,,	Duddon Val., Seathwaite Vic.	3·16	,,	Westport, Murrisk Abbey	2·88
IX.	Baldersby	·88	,,	Crossmolina, Enniscoe ..	2·47
,,	Scalby, Silverdale	·96	,,	Collooney, Markree Obs.	2·93
,,	Ingleby Greenhow Vic..	1·05	XXIII.	Enniskillen, Model Sch.	...
,,	Middleton, Mickleton ...	1·24	,,	Warrenpoint.....	2·78
X.	Beltingham	...	,,	Banbridge, Milltown ...	3·71
,,	Bamburgh	...	,,	Belfast, Springfield	5·52
,,	Keswick, The Bank.....	3·70	,,	Bushmills, Dundarave..	4·71
XI.	Llanfrechfa Grange	2·82	,,	Stewartstown	2·83
,,	Treherbert, Tyn-y-waun	2·78	,,	Killybegs	3·85
,,	Llandovery	1·98	,,	Horn Head	3·69

METEOROLOGICAL NOTES ON SEPTEMBER, 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 two wet and unpleasant days at the commencement, there was a week of almost the finest weather of the whole summer, terminating on 10th with a TS and heavy R. The remainder of the month was remarkably dry, with northerly winds and cloudy skies. Thick fog on the morning of the 19th. Mean temp. 56°·9, or 0°·8 below the average.

ABINGER HALL.—Generally cold and dry with frosts almost nightly after the 17th. Harvest operations closed about the 20th. R is much needed.

TENTERDEN.—Unsettled at first but dry generally, many sunny days with cold nights. Duration of sunshine 180·5 hours.

CROWBOROUGH.—Remarkably dry, the nearest approach since record commenced in 1871 was ·63 in. in 1898. A good deal of sunshine, and the month was the most agreeable of the summer.

WINSLOW, ADDINGTON.—Frequent dense morning fogs, and min temp. often very low.

PITSFORD, SEDGEBROOK. Very fine and pleasant. R 1·38 in. below the average of 10 years. Mean temp. 55°·0.

COLCHESTER, LEXDEN.—First half mild and dull, then some bright weather and heavy dews. Last week cold.

BURY ST. EDMUNDS, WESTLEY.—Dry with no R after 16th.

WINTERBOURNE STEEPLETON.—Again cold, the mean temp. being 1°·1 below the average of 10 years. Rainy days slightly in excess, and the heavy R in the earlier part interfered much with harvest work.

TORQUAY, CARY GREEN.—R ·07 in. above the average. Duration of sunshine 9.3 hours above the average, with three sunless days. Mean amount of ozone 5·2; max. 8·5 on 3rd with W. wind; min. 2·0 on 7th with E. wind.

WELLINGTON, THE AVENUE.—The first half was generally stormy and unsettled, but from 17th to the end R fell on only three days. R about ·25 above the average.

NORTH CADBURY RECTORY.—Damp, cool and equable, with small R, but, up to 23rd inclusive, showery. Temp. very little below the average.

CLIFTON, PEMBROKE ROAD.—Changeable with three short spells of fine weather. R 1·18 in. below the average.

ROSS, THE GRAIG.—Rather cool, but fine and dry. Harvest was nearly completed, and seemed fairly good. R more than an inch below the average, almost all of it falling between 9th and 11th, and 22nd and 23rd. Mean temp. 55°·5.

HULL, PEARSON PARK.—Some cold nights with variable weather.

WALES AND THE ISLANDS.

HAVERFORDWEST.—Wet with light winds. R fell mostly at night. The last seven days were beautifully fine, but with low night temp. Duration of sunshine 154·2 hours. Crops of all kinds were good, but considerable damage was done by the wet.

ABERYSTWITH, GOGERDDAN.—Very cold with little sun; nearly always overcast, but not nearly enough rain.

DOUGLAS, WOODVILLE.—Fine, though the R was considerable. Temp. generally low, especially from 9th to 15th. The last six days very fine, with a marked absence of gales. Violent gale on 3rd, uprooting forest trees.

SCOTLAND.

LILLIESLEAF, RIDDELL.—Dull and showery throughout. The last week was calm and very warm. R ·01 in. above the average. Crops good but green in patches, and plums and apricots hard and shrivelling, reminding one of the old saying, "No fruit ripens in Scotland but roasted apples."

TIGHNABRUAICH.—Marked by three heavy falls, which took place during the night. The dry days were generally cloudy without wind, and not at all ideal harvest weather.

ISLAY, EALLABUS.—On 3rd, 2·93 in. of R fell between 1 a.m. and 4 p.m. Many bridges were broken down, and there was much flooding.

COUPAR ANGUS.—Cloudy skies and sunless days generally. R short of the average, but weather very moist throughout. Mean temp. 52°·8.

DRUMNADROCHIT.—Although the R was 1·19 in. under the average of 16 years, it was so distributed that the month earned the character "wet." Very cold with S and H showers.

WATTEN, H.R.S.—Overcast, cold and wet with very little sun, and generally drizzly.

S. RONALDSHAY, ROEBERRY.—Dull and changeable. Mean temp, 50°·2 or 1°·6 below the average of 12 years.

IRELAND.

BROADFORD, HURDLESTOWN.—Water was very low and many springs were dry that were not remembered to have been so before.

DUBLIN, FITZWILLIAM SQUARE.—Nothwithstanding a violent storm of R on 2nd and 3rd the month proved favourable. Mean temp. 56°·1, or 0°·2 above the average; duration of sunshine 139·5 hours, or 3·9 hours below the average. High winds were noted on six days, attaining the force of a gale on 3rd and 21st.; prevailing wind N.E. and W. Foggy on eight days.

COLLOONEY, MARKREE OBSERVATORY.—Fine on the whole, but many days without R were dull or gloomy, with some cool nights.

OMAGH, EDENFEL.—Some of the heaviest R of the summer fell in the first week, after which there was a favourable spell for some days, with a return to much R from 20th to 26th, when the weather improved, but so stagnant is the atmosphere and heavy the night dews that harvesting is only possible for a few hours daily.

THE NINE MONTHS' RAINFALL OF 1902.

Aggregate Rainfall for January—September, 1902.

Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver	Station.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	+ .03	100	Arncliffe	-15·85	63	Aberdeen	— ·05	100
Tenterden	—3·87	79	Hull	—2·64	85	Cawdor	—1·81	92
Hartley Wintney	—1·72	90	Newcastle	—3·04	83	Strathconan	—5·25	86
Hitchin	+ ·84	105	Seathwaite	-32·57	65	Glencarron	...	...
Winslow	—3·07	82	Cardiff	—4·08	85	Dunrobin	—1·80	91
Westley	— ·68	96	Haverfordwest	—2·85	90	Darrynane	—7·40	78
Brundall	+ ·09	101	Gogerddan	—6·60	78	Waterford	+ ·42	102
Blandford	...	...	Llandudno	—2·46	88	Broadford	—3·65	85
Polapit Tamar	—2·86	88	Dumfries	—7·32	76	Carlow	+ ·44	102
Stroud	— ·61	97	Lilliesleaf	—1·97	91	Dublin	+2·06	111
Woolstaston	+2·48	112	Colmonell	—2·24	93	Mullingar	—4·53	83
Worcester	+1·96	113	Glasgow	—3·97	84	Ballinasloe	—5·12	80
Boston	+2·49	117	Islay	+ .53	102	Clifden	-14·81	73
Hesley Hall	— ·08	99	Mull	—2·41	94	Crossmolina	—4·96	86
Derby	+1·21	107	Loch Leven	—6·10	76	Seaforde	+4·87	119
Manchester	...	...	Dundee	—3·32	83	Londonderry	—2·95	90
Wetherby	—2·34	86	Braemar	—3·64	85	Omagh	+ ·76	103

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1902.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	69·5	19	29·7	7	57·6	39·6	39·5	71	111·3	23·6	·49	10	6·1
Malta	78·4	4	49·2	2	68·5	56·3	54·9	82	138·0	43·4	1·33	6	3·9
Cape Town	90·4	1	44·3	22	70·8	53·5	53·0	72	...	...	2·51	8	4·6
Durban, Natal	86·2	5	56·9	15	80·2	63·3	...	...	139·8	...	2·52	9	3·5
Mauritius	85·9	1	62·4	27	82·9	69·5	68·3	79	148·7	53·4	1·66	12	5·7
Calcutta	97·3	7	67·4	22	92·0	74·5	74·2	72	150·0	65·8	6·11	8	4·9
Bombay	91·9	19	77·3	3	90·2	78·9	75·3	75	140·4	69·6	·00	0	1·3
Madras	98·0	22	73·9	4	93·4	78·3	74·3	74	148·8	70·6	·02	1	3·4
Kodaikanal	74·1	28	49·0	2	70·0	52·9	50·4	70	145·2	37·4	4·33	17	5·2
Colombo, Ceylon	93·2	10	72·8	7	91·0	75·8	75·4	80	149·2	70·0	10·01	18	3·0
Hongkong	86·8	25	56·8	13	77·7	69·6	68·0	83	142·0	...	1·85	8	7·9
Melbourne	88·2	19	43·9	12	67·8	50·2	49·5	73	143·0	34·0	·57	5	5·2
Adelaide	92·3	19	45·4	3	77·5	54·3	46·9	52	141·3	38·5	·37	2	3·6
Coolgardie	97·9	19	45·6	27	85·3	56·1	46·2	41	153·1	39·0	·04	1	2·1
Sydney	80·1	14	51·8	29	69·9	56·9	52·7	77	127·0	41·9	2·67	14	4·5
Wellington	73·0	2	39·0	28	62·6	49·3	46·3	70	109·0	28·0	4·70	20	5·3
Auckland	73·0	4, 5	46·0	13	65·6	55·4	50·8	70	134·0	43·0	6·27	19	5·6
Jamaica, Negril Point	...	...	...	...	86·0	71·5	68·0	70	...	...	2·74	5	...
Trinidad	92·0	21	65·0	2	85·7	69·6	70·3	73	165·0	63·0	1·78	9	...
Grenada	86·4	27	71·8	6	83·9	74·1	69·1	72	153·2	...	2·08	11	2·9
Toronto	75·5	22	26·4	5	52·7	35·2	35·0	72	89·8	...	2·17	15	6·7
Fredericton, N.B.	74·8	29	22·9	7	51·2	30·0	26·5	52	...	...	2·90	14	5·6
Winnipeg	67·0	26	11·0	6	48·5	26·1	...	...	...	...	1·33	4	4·3
Victoria, B.C.	60·6	1	34·0	8	53·8	41·2	...	...	...	...	·95	13	7·7

REMARKS.

MALTA.—Mean temp. of air 61°·0, or 0°·5, above, and mean hourly velocity of wind 9·5 or 2·1 below, average. Mean temp. of sea 63°·4. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·1, dew point 0°·4, and rainfall 3·50 in. below, their respective averages. Mean hourly velocity of wind 6·4 miles, or 4·0 below the average; prevailing direction S.E. to E.N.E. T. F. CLAXTON.

MADRAS.—Mean temp. below normal during first week; afterwards the temp. rose, and on the 26th averaged 4° in excess in the Deccan. Sunshine 246·6 hours, or 66·4 per cent. of possible amount. A. MOFFAT.

KODAIKANAL.—Mean temp. of air 59°·6; sunshine 201 hours; mean daily velocity of wind 240 miles; max. velocity of wind 472 on 1st. C. MICHIE SMITH.

COLOMBO, CEYLON.—Mean temp. of air 83°·4 or 0°·9 above, of dew point 75°·4 or 1°·0 above, and R 1·33 in. below, their respective averages. Mean hourly velocity of wind 5·9 miles, prevailing direction S.W. H. O. BARNARD.

HONGKONG.—Mean temp. of air 73°·1, or 3°·2 above the average. Sunshine 142 hours, or 31 hours above the average. R 3·43 in. below the average of 39 years. Mean hourly velocity of wind 13·4 miles, prevailing direction E. 5° S. F. G. FIGG.

Adelaide.—Mean temp. of air 1°·9 above average of 45 years. C. TODD, F.R.S.

Coolgardie.—Mean max. 8°·9 above average for previous years. W. ERNEST COOKE.

Sydney.—Mean temp. of air 1°·1 below, R 2·89 in. below, and humidity 1°·5 below, their respective averages. H. C. RUSSELL, F.R.S.

Auckland.—R quite double the average of 33 years. T. F. CHEESEMAN.

TRINIDAD.—R ·25 in. below the 30 years' average. J. H. HART.