

Symons's Meteorological Magazine.

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UNPRECEDENTED RAINFALL IN NORFOLK.

THE rain which fell in Norfolk on August 26th and 27th, 1912, was altogether unprecedented for a cyclonic storm in the east of Great Britain. It was the crowning episode of what will probably prove the wettest August on record, and we accordingly devote all our available space to an account of what occurred, and give a preliminary map of the distribution of rain in East Anglia on the two days. The features of the storm were similar in a general way to the great cyclonic fall of rain in the Thames Valley on June 13-15, 1903 (see *British Rainfall*, 1903, pp. 19-30; also this Magazine, **39** (1904), pp. 161-165, and to that on the east coast of England on June 23-24, 1911 (see *British Rainfall*, 1911, pp. [143]-[152]); but in both of those cases the rain area lay in a loop of the track of a depression which turned to the left as it proceeded. On this occasion the relation of the track of the depression to the rain area was exactly similar to that of the great Irish fall of August 24-26, 1905 (see *British Rainfall*, 1905, pp. [110]-[114]), the coincidence of the time of year also being surprisingly close. The Irish depression appeared in St. George's Channel, passed slowly northward into the Irish Sea, and when the centre was off the most easterly point of Co. Wicklow, it turned abruptly eastward and travelled rapidly over England. Torrential rains fell in the east of Ireland, where there was an area of 310 square miles with more than 5 inches of rain (most of it falling on the 25th), and an area of 850 square miles with between 4 and 5 inches; the wettest areas lay to the north-east of the point where the track of the depression turned at right angles to the right.

At 7 a.m. on August 26th, 1912, the Daily Weather Report shows that a trough of low pressure lay across the south of England, and at the east end of it a depression, with less than 29·20 in. pressure lay off the North Foreland. This depression moved slowly northwards into the North Sea, and at 6 p.m. had deepened to less than 29·00 in. off the most easterly part of the Norfolk coast. Some time after this hour the track seems to have turned to the right, for by 7 a.m. on the 27th, the centre of the depression, now filling up, had moved

quickly across the North Sea to near Helgoland. The area of torrential rain lay centrally in the north-east of Norfolk, and a provisional computation shows that 870 square miles had more than 5 inches for the two days (but most fell on the 26th) and 900 square miles had between 4 and 5 inches.

The storm seems to have been central close to Norwich, and the following letters give some of the more important facts and impressions recorded by our correspondents. Mr. A. W. Preston, whose unremitting attention has brought rain-observing in Norfolk to a high degree of excellence, is well known to our readers, and Mr. J. H. Willis has an observational equipment as nearly perfect as instruments can be. The letters from Rev. F. W. Walter and from Mr. R. Cross show that the course of events at Worstead was very similar, though the discrepancy between the amounts measured has still to be enquired into.

AT EATON, NORWICH.

We have had a most extraordinary rainfall here. My figures are :—

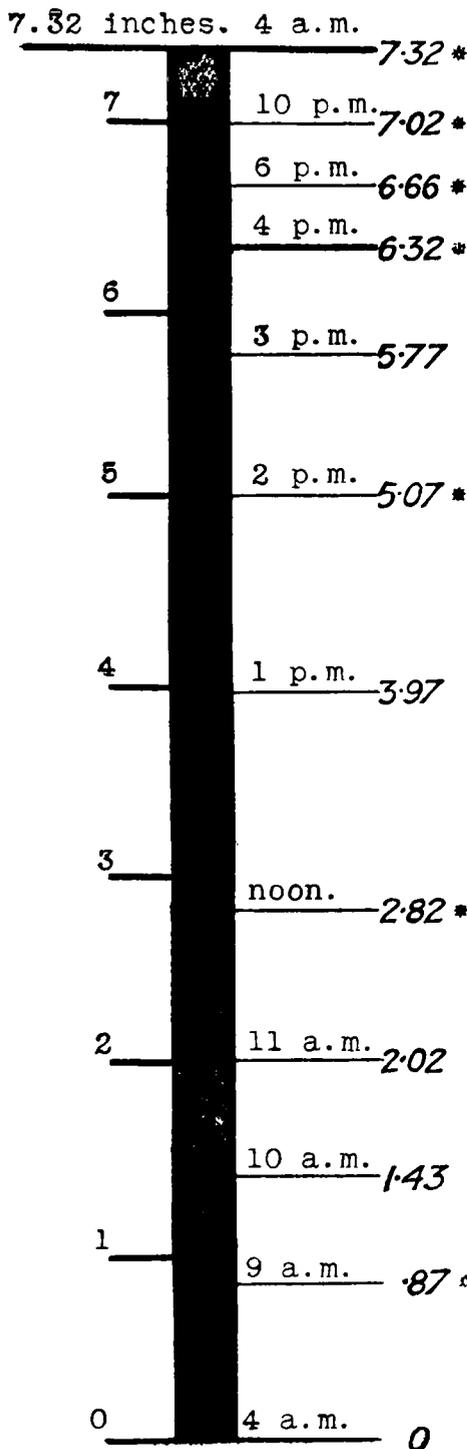
	in.
From 4 a.m. to 9 a.m. (August 26th)	1·03
„ 9 a.m. to 3.15 p.m.	4·96
„ 3.15 p.m. to 5.40 p.m.	·60
„ 5.40 p.m. to 9 a.m. (August 27th)	·75
Total in 29 hours	7·34

A gauge of a friend of mine half a mile away showed 7·36 in. in the same period.

It was an awful visitation, and I shall never forget it. It was not a straight, hard thunder-rain, but reminded me more of the blizzard of fine snow which fell during the great snowstorm of 18th January, 1881, which I well remember. We have not had such a day here since. The floods are terrible. The train service, tram service and electric light service all discontinued, and many of the streets and roads in low-lying parts of the city are like rivers, and in the Cathedral close there is a large lake. There is no record of anything like it in East Anglia, the “great Norwich flood” of November, 1878, sinking into insignificance beside it. Mr. C. Knight, Keswick, near Norwich, measured on August 26th :—

	in.
8.45 a.m.	·82
0.55 p.m.	3·35
2.15 p.m.	·95
6.35 p.m.	1·20
8.45 a.m. (August 27th) ..	·56
Total	6·88

ARTHUR W. PRESTON.



AT IPSWICH ROAD, NORWICH.

As my readings of the rainfall were more frequent than Mr. Preston's, I thought possibly the enclosed copy of a rough rainfall diagram I had prepared for the press might be of interest to you. To the right of the diagram I have entered figures giving for each hour the depth reached by the rain during the greater part of the day. The figures I have marked with an asterisk are from readings taken exactly at the hour named. In the case of figures not marked with an asterisk, readings were not taken exactly at the hour named; but though these figures are, therefore, to a slight extent estimated, they can be relied on as substantially correct.

As you will see I recorded 6.32 in. in the 12 hours to 4 p.m. on the 26th, and a further inch exactly in the following 12 hours. Only .04 in. fell between 4 a.m. and 9 a.m. on the 27th, making 7.36 in. in the 29 hours.

My gauge was recently inspected and measured by Mr. Marriott, who found it in perfect order, and reported its exposure as excellent. The measuring glass bears Mr. Symons's certificate.

JOHN H. WILLIS.

AT THE GRANGE, WORSTEAD.

It is now possible to view with calmness, but with sadness, the dark dreadful

month of August. Never shall we forget the week commencing on Sunday, the 24th. The first day of the week was bright and hopeful, and though it closed with a slight appearance of rain, yet the moon was shining brightly and the haze towards midnight passed away. Between three and four o'clock on Monday morning rain began to fall, and fell so steadily that at 9, when I emptied my rain gauge, I recorded a fall of .98 in. The wind was then in the N.E., and both wind and rain increased in power and fall. At 1.30 I again measured rainfall and found that 1.40 in. had to be recorded; at 3.20 I recorded 1.12 in.; at 4.15, .92 in.; at 6, 1.15 in.; at 6.30, .22 in.; and at 9 next morning, 1.50 in.; making a grand total, from 3.30 on Monday morning to 9 on Tuesday morning, of 7.29 in. Towards the evening of Monday the wind shifted to N.W. and increased in violence and the darkness grew in intensity, until one felt to be in the centre of an inferno, and wondered what would happen next.

FREDERICK W. WALTER, F.R.Met.Soc.

AT LYGATE COTTAGE, WORSTEAD.

We had a remarkable rainstorm here on August 26th which yielded 5.89 in. in the 24 hours, by far the largest amount I have ever registered in one day during the last 25 years. The total for the month is 9.86 in., which is a record. The barometer fell to 28.95 inches, which is also a record for August.

The damage done is enormous. More than 40 road bridges have been swept away, railways flooded and trains stopped. The wind backed from S.E. to N.W., and blew a gale. Thousands of trees have been blown down.

ROBERT CROSS.

IMPRESSIONS OF A METEOROLOGIST.

I HAD the good fortune to experience the early part of the tremendous deluge of August 26th in Norfolk, which has isolated Norwich and interrupted the fine express service between London and the Norfolk coast. I left Norfolk by an early train on the morning of the 26th during a torrential downpour, but it may be that the greatest intensity was not experienced till later in the day. I can only describe the rain as like a continued shaft of arrows swept by a wind which suddenly rose to a hurricane. Like all, or very nearly all, persistent heavy rains in the level parts of England, the wind was east, and it is noteworthy that, as my train passed into Essex about 10.15 a.m., the storm abated with a shift of wind to the south-west. As the express swept through Suffolk the landscape appeared almost obliterated in the torrents of rain, and the tree forms loomed out black and impressive in the heavy gloom.

The high wind and arrow-like texture of rain accentuated the alarming character of the deluge, following after two very wet days, the 23rd and 24th.

L. C. W. BONACINA.

The fact of 7·34 in. falling in a continuous rain of 24 hours, from 4 a.m. on the 26th to 4 a.m. on the 27th, is very remarkable, and we owe a peculiar debt of gratitude to Mr. Willis for his enthusiasm in visiting his rain gauge at such an unwonted and uninviting hour. Though this is not one "rainfall day," and we cannot compare it with other falls, it has certainly not been surpassed in the British Isles on more than two or three occasions. The records exceeding 6 inches in a rainfall day are very few, and all except two of those previously experienced occurred either in the Lake District, in the mountainous part of Wales, or in the West Highlands. The fall of 8·06 in. recorded at Brundall, 5 miles east of Norwich, for the two days is greater than the largest rainfall for the 24 hours of a rainfall day ever recorded in this country, with the single exception of the Scarborough rain of 1857. We cannot rely on data previous to 1860, and we have only newspaper notices, not authenticated by a signature, of the fall of more than 9 inches in one day at Scarborough on August 9th, 1857. The rain gauge is said to have been found overflowing, with nine and a half inches in the receiver; but there is no exact measurement. The recent Norwich falls certainly help to render it more credible, and we should welcome fuller particulars if they could be obtained. The great falls which we believe to be satisfactorily established before August, 1912, are:—

in.		
8·03	at Seathwaite	12th November, 1897.
7·74	,, Ben Nevis Observatory.....	6th February, 1894.
7·29	,, ,, ,,	2nd October, 1890.
7·00	,, Seathwaite	29th October, 1911.
6·94	,, Rosthwaite	12th November, 1897.
6·79	,, Seathwaite	30th September, 1890.
6·78	,, ,,	8th May, 1884.
6·70	,, ,,	13th November, 1869.
6·70	,, Angerton Hall, Morpeth	7th September, 1898.
6·47	,, Seathwaite	4th December, 1864.
6·46	,, Kinlochquoich	2nd February, 1909.
6·41	,, Seathwaite	30th May, 1865.
6·38	,, ,,	16th November, 1866.
6·35	,, Skelwith Bridge, Ambleside ..	12th November, 1897.
6·32	,, Lochbuie	9th December, 1909.
6·15	,, Seathwaite	28th January, 1906.
6·14	,, ,,	24th August, 1891.
6·14	,, Bwlch, Glamorgan	10th December, 1909.
6·03	,, Skelwith Fold, Ambleside	12th November, 1897.

It thus appears that only twice since the publication of *British Rainfall, 1860*, has a greater fall than the 7·34 in., observed by Mr. Willis in 24 hours, been recorded for the British Isles, and even if we reduce the comparison to the 24 hours of the rainfall day, the 6·59 in. recorded at Heigham has only been exceeded on nine

occasions, all except one in the wettest parts of the Lake District or of Scotland.

The list which follows gives the rainfall of August 25th and 26th, 1912, separately, the total for the two days, which was all comprised in little more than 24 hours and fell in a continuous downpour, and the total for the month of August at the twenty-one stations at which more than 5 inches has been recorded in one rainfall day. It will be observed that while 50 years of observations in the wettest parts of the British Isles can only produce 19 instances of falls exceeding 6 inches in one day, and only on one occasion has so great a fall occurred at more than one station on the same day, we find here on August 26th, before half of the rainfall records of the district affected have been received, no less than 9 instances of falls exceeding 6 inches, and that not all in one spot, but at places 20 miles apart from north to south, and 12 miles apart from east to west.

Rainfall exceeding 5 inches on August 26th, 1912.

	Aug. 25th.	Aug. 26th.	Total for 2 days.	Total for August.
	in.	in.	in.	in.
Brundall.....	·78	7·31	8·09	11·18
Norwich (Heigham).....	·92	6·59	7·51	11·36
„ (Ipswich Road)	·87	6·49	7·36	...
„ (Eaton)	1·03	6·31	7·34	11·27
Hethersett.....	1·75	5·58	7·33	11·21
Worstead (The Grange)	·98	6·31	7·29	10·88
Dunston	1·09	6·13	7·22	10·61
Moulton	1·12	6·01	7·13	10·41
Swainsthorpe.....	1·11	5·90	7·01	10·02
Gunton	·43	6·46	6·89	10·60
Coltishall	·70	6·18	6·88	10·16
Keswick	·82	6·06	6·88	10·61
Saxlingham	1·20	5·45	6·65	9·54
Sheringham .....	...	5·73	...	...
Drayton	·90	5·70	6·60	10·31
Ormesby.....	1·42	5·17	6·59	10·14
Wymondham.....	1·19	5·33	6·52	9·91
Honingham	·60	5·62	6·22	9·67
Cawston	·75	5·30	6·05	9·75
Rippon Hall	·51	5·54	6·05	9·43
Worstead	·34	5·55	5·89	9·86

The Angerton Hall fall of 7th September, 1898, was due to a thunderstorm, and the area with more than 4 inches of rain probably measured less than 50 square miles, while the fall only lasted for a few hours. The magnitude of the Norfolk downfall depends less on its intensity than on its long duration, and the large area which was affected. The map which we give has been compiled from the data of 129 Observers, and it has, of course, been impossible in the time at our disposal to enquire into discrepancies, or to decide between conflicting figures, though serious differences are few.

The area with more than 7 inches of rain in the two days seems to have extended from 6 miles S.W. of Norwich almost to the coast at Horsey, 15 miles to the N.E., and the greatest breadth of this very wet area from Crostwick to Cantley was about 10 miles; it included practically the whole of the Broads. The area with more than 6 inches probably reached the coast at Triningham and Caister, and extended far out to sea; while more than 5 inches descended on a great area which meets the sea between Blakeney and Gorleston.

Measurements on the preliminary map facing p. 159 show that for the two days in question the rainfall exceeded 2 inches over about 6,000 square miles, it exceeded 3 inches over 3,000 square miles, exceeded 4 inches over 1,800 square miles, exceeded 5 inches over about 900 square miles, exceeded 6 inches over more than 500 square miles, and culminated in about 180 square miles where more than 7 inches of rain fell. The county of Norfolk, with an area of 2,044 square miles, had a general rainfall of probably 4·88 in., which corresponds to 9,970 square mile inches, or 144,400,000,000 gallons of water. This is twice as much water as is contained in Windermere, the largest of the English lakes, and its weight is 644,000,000 tons. Had this precipitation fallen in the form of snow, the average depth at which it would have lain over Norfolk would have been almost 5 feet; increasing from less than 3 feet near Lynn to more than 7 feet over nearly 200 square miles around Norwich, supposing that it fell in a dead calm and did not drift. The occurrence of such a snowfall with a gale of wind would cause drifts which might have buried Norwich beneath a snow-dune, which could not have been cleared away for weeks. There is no reason why such a storm should not occur in winter, and no reason why it should not occur in any part of the British Isles; though the probability of its happening is apparently too small to make it prudent to take steps beforehand to cope with the emergency should it arise.

In a country where the configuration of the land and the direction of the prevailing wind conspire to produce a high rainfall at all times, the action of rain and the resulting streams working for ages have deepened out channels which allow the great precipitation to escape rapidly to the sea or to lakes which pass on the flood water at a uniform rate. Hence, even an occasional fall of 6 inches or more in a day produces no serious result. In the east of England, however, and especially in such a district as the north-east of Norfolk where the average annual rainfall is under 30 inches, where the land is little raised above sea-level and the valleys scarcely hollowed below the general surface, such a visitation is disastrous in the extreme, and the most remarkable feature of the flood is the extraordinarily small loss of life it occasioned. So far as we are aware only two or three persons were drowned. This immunity, as far as Norwich is concerned, was probably due to the fact that the greatest area of heaviest rain lay below the city or to the north of the watershed separating the river Bure, which flows through the Broads on the

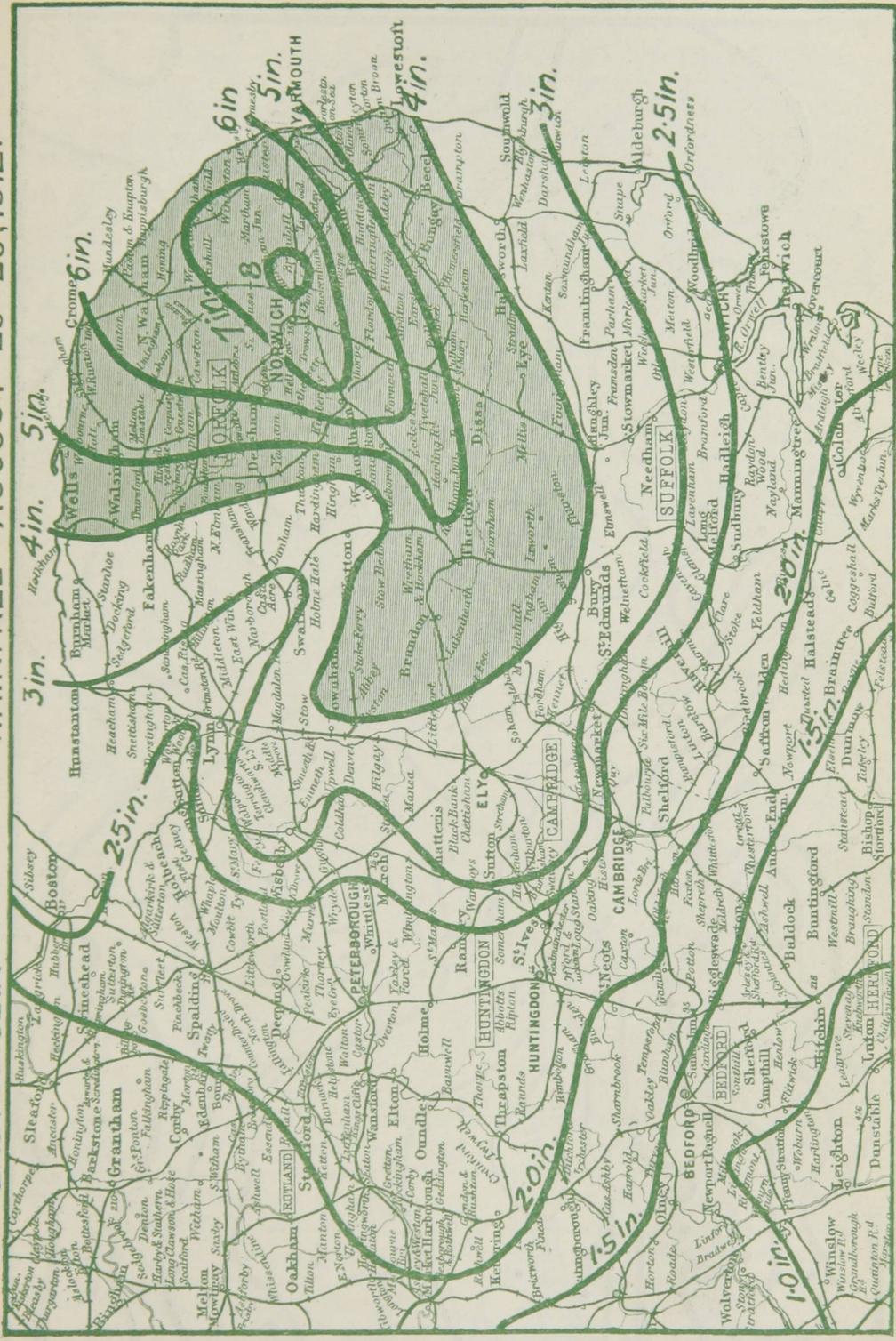
north-east, from the river Yare, which receives large tributaries from north-west, west and south at the lower end of Norwich itself. Had the centre of heaviest rainfall chanced to lie 10 or 15 miles farther to the west than it happened to be, the destruction would have been incalculably greater, as instead of the great bulk of the unexampled precipitation falling directly upon the water surface of the Broads, it would have come upon the higher land above Norwich, and the rivers converging on the city would have continued to rise for a long time instead of falling soon after the rain stopped; for it must be remembered that the distribution of the rain was actually such that least fell in the source region of the rivers and most near the mouth. But for the vast water-surface of the Broads allowing the flood to spread with the rise of a few feet, the town of Yarmouth must have suffered far more than Norwich did, and it may be said that on this occasion the Broads saved Yarmouth.

It is most difficult to give in reasonable compass a description of the nature of the floods or of the damage done. The crops in the north-east of Norfolk have been destroyed, the harvest was postponed to an exceptionally late period by the inclement weather of the earlier part of August, and the catastrophe carried away the grain that had been cut but not brought in, and made it impossible to save what remained uncut. The flooded rivers destroyed bridges over a great area, the number which went down is given officially as forty-two. Curiously enough most of the reports of damage which we have received come from places to the south and west of Norwich, where the amount of rain that fell was considerably less than to the east and north.*

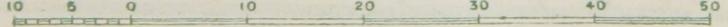
The rainfall and the rising flood in Norwich stopped all railway traffic with the city on Monday afternoon, and no train entered or left on Tuesday or on Wednesday until the evening, railway communication being thus suspended for more than two days and nights. The local electric tramways were also arrested; there was no public supply of light by gas or electricity for two nights, and a square mile of streets in the lower part of the town was under water. The depth of water in the quarter where the poorer people lived was 13 feet, so that the ground floor rooms were filled and the first floor rooms flooded out. One of the minor industries of Norwich is canary breeding, and the birds are reared for the most part by working men, who keep the cages in sheds in their gardens. These were the first to be flooded, and as the first concern was necessarily the saving of human life no attempt could be made to move the cages. The fear

* The actual centre of highest rainfall may have been in Norwich itself, although the slightly higher figure at Brundall suggests a more easterly position. The risk of error in rainfall measurement is always greatest in the case of extremes, and even careful Observers may easily make mistakes when the readings are of such an altogether exceptional amount. All we say in this article, which has had to be written before any checking or critical examination of the figures is possible, has to be taken as provisional.

EAST ANGLIA — RAINFALL AUGUST 25-26, 1912.



ENGLISH MILES, 19 MILES TO ONE INCH

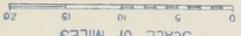


THAMES VALLEY RAINFALL - AUGUST, 1912.

ALTITUDE SCALE

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

SCALE OF MILES



was expressed that at least one particular strain of Norwich canary has been wiped out. Many remarkable escapes of people rescued from the upper windows of their houses are recorded, and there were instances of heroism in saving life by means of such boats as could be secured, which would have reflected glory on the trained crew of a shipwrecked vessel, equipped with all the best appliances kept in a state of instant readiness.

The flooded roads and broken bridges made all travelling by road dangerous and circuitous. A motor car going to one of the villages in the north-east and back on the afternoon of the 26th, took seven hours to accomplish a journey which usually occupies forty minutes.

The municipal authorities rose to the occasion, and arrangements were speedily made for throwing open the schools in the higher parts of the town as temporary shelters for the thousands who were rendered homeless. Everything had to be done on the evening of Monday, and all through the long night, in an unceasing deluge of rain, driven by a furious gale. Trees were blown down, walls were sapped by the water and collapsed, and the torrents that rushed through the streets were charged with wreckage of every kind. One boatman, William John Marrison, says the *Eastern Daily News*, remained in his boat from 11 a.m. to 11 p.m. on the 27th, without intermission, and in that time conveyed a hundred people from their flooded houses to a place of safety; while he and a policeman were continuing the work, the boat was caught by a furious current, and carried into a narrow passage, where it was wedged tight. The policeman got over a wall, and made his way to the police office, where he reported that he had seen the boatman carried away and drowned; but in half an hour, Marrison also came in to report the drowning of the policeman, and this pleasant incident terminated the great day's work. The damage will take a long time to repair, and a relief fund is being raised to help the poorer inhabitants, the amount subscribed up to September 6th being £17,800.

The detail with which we have treated the Norfolk storm has made it impossible to deal with the remarkable features of the rainfall of August in the country as a whole. The month was very wet everywhere; the only places with less than 4 inches of rain were narrow strips along the estuaries of some parts of the east coast of Great Britain, the western Hebrides, and the west of Ireland, which was the driest part of the British Isles last month. More than 10 inches fell in the north-east of Norfolk, throughout Cornwall, most of Devon and much of Somerset, in central Wales and the Lake District, but no part of Scotland or Ireland seems to have had so much. Our map of the Thames valley shows high rainfall in all parts, the total fall being 240 per cent. of the average, and the month the wettest August since a systematic comparison became possible in 1883, and only four months in that time (October, 1891 and 1903, December, 1911, and September, 1896) have had more rain than August, 1912.

THE WEATHER OF AUGUST.

By FRED. J. BRODIE.

THE anticyclone which in a normally fine summer extends over these islands now and again from the southern portions of the North Atlantic, was restricted last month to its place of origin; and in the absence of this barrier, the way lay open for the advance of oceanic depressions from the westward. But this was not all. In addition to the anticyclone which occupied a very ordinary position between the Azores and the Spanish coasts, another high-pressure system of almost equal intensity lay over and to the northward of Iceland. The conditions were, therefore, not only favourable for the advance of depressions, but were eminently favourable for their development over the northern and middle portions of the Atlantic, and in the course of the month the country witnessed an almost unbroken procession of these systems, moving mostly from west to east or from south-west to north-east. The chart of mean pressure for the month shows that while the Azores readings were about equal to the average, those in Iceland were about a quarter of an inch above it. Between the two regions the British Islands lay in a trough of low pressure which stretched from the Atlantic across the entire northern half of Europe. The result was seen in what was undoubtedly the coldest and also in many places the wettest August the present generation has witnessed.

Within recent years there have been, we imagine, very few cases, if any, in which the maximum shade temperature in August has failed to reach 80° in some portion at least of the United Kingdom. An examination of a large number of records for last month yields no instance of a reading as high even as 75° , and very few cases of any reading as high as 70° . On the 3rd of the month a maximum of 71° was recorded at Camden Square, while on the following day the thermometer reached 70° in several parts of our eastern midland and south-eastern counties, and touched 72° at Margate and 73° at Greenwich and Camden Square. The only other instances of the kind occurred on the 11th, 18th, and 29th, when a reading of 70° recorded at Greenwich, and on the 30th when a similar temperature was observed at that Observatory and at Camden Square, as well as at Fulbeck. As absolute maxima for August the readings were the lowest ever recorded, but the London district seems to have been more highly favoured than other parts of the United Kingdom; at many places in the west and north the thermometer scarcely ever reached 65° . The absence of warmth was due partly to the almost constant prevalence of a current of air blowing from the cool surface waters of the Atlantic and partly to the unusual cloudiness of the sky. The sunshine records for the month show that at a very large number of places situated in nearly all parts of Great Britain, the total duration of that very desirable element was less than half the average; at Pembroke it amounted to little more than one-third.

The cloud canopy naturally served to hinder the progress, not only of solar, but also of terrestrial radiation ; and although the mean of the minimum temperatures was below the average, the deficiency of warmth was less marked at night than in the daytime. Slight frost was, however, experienced at rare intervals in many northern and inland districts, the lowest temperatures of the month being recorded, as a rule, on the night of the 2nd, when the sheltered thermometer fell below 35° in many parts of the United Kingdom. On the surface of the grass the minima on that occasion were as low as 25° at Birmingham, 28° at Crathes (Kincardineshire) and Llangammarch Wells, and 30° at West Linton and Hereford. Slight touches of ground frost were experienced also in many inland districts on the nights of the 11th, the 20th-22nd, and the 27th.

The passage of the numerous Atlantic disturbances resulted in much rough weather along our south coasts, the wind rising not infrequently to the force of a gale from the westward or south-westward. The depression which was associated with the phenomenal rain storm of the 26th came northwards from the Bay of Biscay ; and on the morning of that day, when the centre lay over the Thames estuary, the surrounding winds were of little strength. Later on the disturbance increased rapidly in intensity, and produced a gale in the eastern counties, at first from the north-eastward and afterwards from the westward. The westerly gale blew with sufficient violence to overthrow trees, and to cause locally a considerable amount of structural damage.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

JUNE IN THE PYRENEES.

THE descriptions of the photographs which appeared with the above article in the last number were accidentally omitted, and where appended in the note on p. 147 were given wrong.

Fig. 1 is taken from the summit of the Taillon, 10,300 ft. looking east, and shows the highest of the Gavarnie peaks, viz., Marboré, to the left ; the Cylindre (centre) and Perdu 10,995 ft. to right. The actual cairn of the Taillon is seen below the then highest point, owing to the cornice which gives place on the left of the picture to the northern precipice.

Fig. 2 shows Brèche de Roland—the conspicuous gap in the rock wall. The Taillon is the snowy peak further to the right, and the lowest point of the sky line shows the Porte d'Espagne—the mule

track into Spain. The rock peak on left of the photo is some 400 ft. lower than the Taillon, and can also be seen in Fig. 1 at the end of the rock wall (in which the Brèche occurs), which is here seen end on.

Fig. 3 is taken from the Brèche, and the sunshine streaming through the gap may be seen between the two shadows on the left. In the distance, on left, appears the Vignemale, 10,820 ft. The Brèche itself was far too stupendous to photograph at such close quarters.

R. P. DANSEY.

[The description of the photographs was received after the August *Magazine* had been passed for press. The abbreviated titles had to be telephoned to the printer and it was impossible to see a proof.—Ed. *S.M.M.*]

AUGUST RAINFALL AT GREENWICH.

THE rainfall recorded at the Royal Observatory, Greenwich, in August, amounted to 4.14 in., exceeding the average for the preceding 97 years by 1.84 in. This month's fall has been exceeded six times in previous Augusts, viz., in 1837, 4.52 in.; in 1848, 4.25 in.; in 1852, 4.35 in.; in 1878, 5.38 in.; in 1879, 5.19 in., and in 1903, 4.82 in.

W. C. NASH.

Blackheath, September 5th, 1912.

AUGUST, 1912, IN YORKSHIRE.

I VENTURE to send a few notes on the above exceptional month.

		Diff. from Average.	
Barometer, 9 a.m.	29.687	-0.239	Lowest in record.
Mean Max. Temp. ...	59° 6	-5° 6	" " "
Absolute Max. Temp.	65° 7		" " "
Mean Temp.	53° 8	-4° 0	One lower, 1885, 53° 7
Rainfall	6.92 in.	+3.32 in.	One higher, 1891, 7.40
Rain Days	27	+10	Most in record.

My record extends from 1879 for temperature, and from 1881 for rainfall. This, for combined wet and cold, is the worst August since 1879, and probably since 1860. 1885 was slightly colder, but was a very dry month; 1891 had more rain, but was two degrees warmer. The only summer months comparable with this are July, 1879, and July, 1888; the former was perhaps more gloomy, but had less rain; the latter was equally deficient in warmth and had rather more rain, but on fewer days.

As regards the three summer months of 1912 taken together, several years have been colder, but the rainfall (16.26 in.) is much the largest, and the rain days (72) are three in excess of 1882, the next highest number.

CHARLES L. BROOK.

Harewood Lodge, Meltham, Sept. 3rd, 1912.

AUGUST RAIN AND CRICKET.

DURING the last three days of last week, eight first-class cricket matches were in progress—namely, at Lords, Leyton, Manchester, Dover, Hastings, Worcester, Hinckley, and Cardiff.

When I opened my newspaper on Saturday morning (August 24th) it struck me as being very unusual to read that no play had been possible in any of the above matches during the previous day. But when I read in Monday's newspaper that again on Saturday not a ball had been bowled in any of these matches, it struck me as being more unusual still. I cannot remember ever having noticed before such an occurrence, even for one day, and for two days in succession it seems to be unprecedented in my recollection. The newspapers took some notice of the fact as being unusual, but I am not aware of any records by which it can be ascertained whether such an event has ever occurred before.

Of course, the absence of play in a cricket match is not necessarily due to rain falling during the day. It may equally well be due to the ground being so saturated with recent rain as to be unfit for play. But the fact that no play was possible for two days in succession in eight places so far apart as those named, does point to the recent wet weather having occurred over a very large part of England.

C. STEWART KING.

Cleveland, Mill Hill, N.W., 27th August, 1912.

CLOUD PARTICLES AT LOW TEMPERATURES.

By JOHN AITKEN, LL.D., F.R.S.

As the condition of cloud particles when the temperature is below the freezing point is at present being discussed in your pages, I would like to call attention to some experiments on this point which were communicated to the Royal Society of Edinburgh, in 1893. Observations were made on fog particles by means of a low power microscope. The particles were observed as they fell on a glass micrometer illuminated by a spot mirror. Observations were made when the temperature was 27° , after a night minimum of 24° , showed that the particles were then liquid. There were, unfortunately, no opportunities for observing at lower temperatures; but the above test showed that they were still liquid after being exposed to a temperature 8° below freezing. Artificially produced cloud particles were also found to be liquid, though formed at some degrees below freezing-point. Theory and other experiments show that this is only what might be expected.

The possibility of the presence of both ice and water particles at the same time in clouds at temperatures below 32° introduces some interesting complications. If the particles be all solid or ice, then

there will be a stable condition. It will also be stable if they be all liquid, but very unstable if some particles be solid while the others are liquid. The cause of this instability is due to the vapour pressure at an ice surface being different from that at a water surface at the same temperature. Sir William Ramsay and Dr. Young showed, in 1884, that the vapour pressure at a water surface at temperatures below 32° was greater than at an ice surface at the same temperature. We see from this that if some of the cloud particles freeze, then these ice particles will at once begin to rob the liquid ones of their water and will grow in size, while the liquid ones will decrease, and probably return to their original condition of dust nuclei. It is not at present known how cloud particles combine to form raindrops. It does not seem likely that the differentiating process which goes on in all newly-formed clouds, by which the larger particles, owing to their greater radius of curvature, rob the smaller ones of their water, can explain the process, as it seems to stop while the particles are still much under the size of raindrops. It is generally supposed that something causes a number of particles to coalesce and form raindrops. From lack of knowledge, we generally think of this as one of the many unknown effects of electricity. At all events, it is evident that raindrops might be made by the coalescing of cloud particles. Now no such process is possible in the case of snowflakes; they evidently are not formed by aggregations of small ones, but what has been stated above about vapour pressures clearly shows how they are grown. Suppose a cloud to form and that the particles are all in the liquid condition. Then suppose some of these particles to freeze, the atmosphere will be in a supersaturated condition to these frozen particles, they will, therefore, at once begin to grow rapidly, and to rob the liquid ones and dry them up. These solid particles, being fed with vapour, are formed under conditions free from restraint, and develop those well-known beautiful and regular crystals which we call snowflakes.

In the Report of the Royal Meteorological Society, given in your July number, Dr. G. C. Simpson mentions among his experiences when enveloped in fog at a very low temperature, that "the fur of his sleeping bags and the wool of sweaters became covered with hoar frost." Hoar frost is sometimes called frozen dew. It may be, but it very often is not, and the heavy deposits of it never are. In Dr. Simpson's case it was not likely to be frozen dew, as there would under the conditions be but little radiation. In a paper communicated to the Royal Society of Edinburgh, in 1887, it is shown that the explanation above given of the growth of snowflakes, also applies in most cases to hoar frost. The heaviest deposits of hoar frost are formed during foggy conditions, when all radiation is cut off. The hoar frost is formed by the cold foggy air, the vapour tension of which is higher than that of the frozen surfaces with which it comes in contact. This also explains why it is that these hoar frosts grow mostly on the side of the branch or blade of grass towards which the

wind is coming, just as if it were grown up of solid particles carried by the wind; and, no doubt in a few cases this may be so, but in general, especially at low levels, the regularly formed crystals of these deposits show that they have been formed *in situ* out of vapour in the passing supersaturated air.

There is a point about which we are at present entirely ignorant, and that is, Does the vapour in the atmosphere ever condense in the form of ice on dust or other nuclei? I might suggest here that this is a point which some institution provided with means of producing low temperatures might make the subject of investigation.

INTERNATIONAL BALLOON ASCENTS.

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

March 3rd, 1910.

Starting Point	Country.	A miles.	B ° F.	C miles	D ° F.	E miles.	F
Manchester....	England	7·5	—71	11·6	—60	30	N.N.W.
Pyrton Hill....	„	6·6	—80	7·4	—71	25	N.
Petersfield	„	6·9	—76	9·1	—66	12	W.
Brussels	Belgium	6·7	—80	7·0	—78	40	W.S.W.
Hamburg	Germany....	7·5	—76	7·7	—72	7	W.S.W.
Lindenberg ...	„	?		6·6	—78	4	N.E. by E.
Paris.....	France	6·9	—67	11·2	—65	34	S.S.W.
Strassburg	Germany....	6·4	—72	8·5	—63	35	W.
Vienna	Austria	7·2	—80	8·4	—63	32	W. by N.
Pavlovsk	Russia	6·4	—71	6·9	—66	40	S.E.
Nizhni Olchedaëff	„	6·5	—80	7·4	—70	31	W.S.W.

A Height in miles of commencement of isothermal column.

B Temperature, F°, at bottom of column.

C Greatest height of reliable record in miles.

D Temperature, F°, at greatest height.

E Distance in miles of point where balloon fell.

F Bearing of falling point from starting point.

An extensive anticyclone lay over the southern part of the Baltic, and the whole of Europe, except the extreme west, was under its influence. The figures are quite normal for the season and the conditions, excepting that it is unusual to find so many instances of a westerly drift of the balloons. As is usual in such cases the distances are small.

RAINFALL TABLE FOR AUGUST, 1912.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH.	
					Aver. 1875— 1909. in.	1912. in.
Camden Square.....	London.....	51 32	0 8	111	2'39	4·89
Tenterden.....	Kent.....	51 4	*0 41	190	2'42	6·23
Arundel (Patching).....	Sussex.....	50 51	0 27	130	2'52	7·70
Fawley (Cadland).....	Hampshire.....	50 50	1 22	52	2'85	6·66
Oxford (Magdalen College).	Oxfordshire.....	51 45	1 15	186	2'44	4·57
Wellingborough (Croyland Abbey).	Northampton.....	52 18	0 41	174	2'38	6·41
Shoeburyness.....	Essex.....	51 31	*0 48	13	1'74	3·34
Bury St. Edmunds (Westley)	Suffolk.....	52 15	*0 40	226	2'52	8·29
Geldeston [Beccles].....	Norfolk.....	52 27	*1 31	38	2'22	7·56
Polapit Tamar [Launceston]	Devon.....	50 40	4 22	315	3'17	9·55
Rousdon [Lyme Regis].....	".....	50 41	3 0	516	2'84	7·28
Stroud (Upfield).....	Gloucestershire..	51 44	2 13	226	2'90	7·24
Church Stretton (Wolstaston)..	Shropshire.....	52 35	2 48	800	3'43	7·31
Coventry (Kingswood).....	Warwickshire.....	52 24	1 30	340	2'81	6·47
Boston.....	Lincolnshire.....	52 58	0 1	25	2'39	6·30
Worksop (Hodsock Priory).	Nottinghamshire	53 22	1 5	56	2'55	4·79
Macclesfield.....	Cheshire.....	53 15	2 7	501	3'76	6·86
Southport (Hesketh Park)..	Lancashire.....	53 38	2 59	38	3'73	4·81
Arncliffe Vicarage.....	Yorkshire, W.R.	54 8	2 6	732	5'62	5·80
Wetherby (Ribston Hall)...	".....	53 59	1 24	130	2'78	5·37
Hull (Pearson Park).....	"..... E.R.	53 45	0 20	6	3'05	4·95
Newcastle (Town Moor) ...	Northumberland	54 59	1 38	201	3'20	4·33
Borrowdale (Seathwaite) ...	Cumberland.....	54 30	3 10	423	11'47	12·75
Cardiff (Ely).....	Glamorgan.....	51 29	3 13	53	4'54	9·92
Haverfordwest.....	Pembroke.....	51 48	4 58	95	4'21	7·66
Aberystwyth (Gogerddan)..	Cardigan.....	52 26	4 1	83	4'88	9·59
Llandudno.....	Carnarvon.....	53 20	3 50	72	3'16	5·55
Cargen [Dumfries].....	Kirkcudbright...	55 2	3 37	80	4'23	6·06
Marchmont House.....	Berwick.....	55 44	2 24	498	3'54	4·53
Girvan (Pinmore).....	Ayr.....	55 10	4 49	207	4'54	4·85
Glasgow (Queen's Park) ...	Renfrew.....	55 53	4 18	144	3'62	4·06
Inveraray (Newtown).....	Argyll.....	56 14	5 4	17	6'02	4'31
Mull (Quinish).....	".....	56 34	6 13	35	5'00	3·80
Dundee (Eastern Necropolis)	Forfar ..	56 28	2 57	199	3'34	3·91
Braemar.....	Aberdeen.....	57 0	3 24	1114	3'63	4·52
Aberdeen (Cranford).....	".....	57 8	2 7	120	3'07	5·34
Cawdor.....	Nairn.....	57 31	3 57	250	3'05	4·43
Fort Augustus (S. Benedict's)	E. Inverness.....	57 9	4 41	68	3'52	3·39
Loch Torridon (Bendamph)	W. Ross.....	57 32	5 32	20	6'61	5·79
Dunrobin Castle.....	Sutherland.....	57 59	3 56	14	2'71	6·38
Wick.....	Caithness.....	58 26	3 6	77	2'73	4·97
Killarney (District Asylum)	Kerry.....	52 4	9 31	178	4'57	6·06
Waterford (Brook Lodge)...	Waterford.....	52 15	7 7	104	3'73	4·68
Nenagh (Castle Lough).....	Tipperary.....	52 54	8 24	120	4'04	3·44
Miltown Malbay.....	Clare.....	52 52	9 26	400	4'98	5·51
Gorey (Courtown House) ..	Wexford.....	52 40	6 13	80	3'31	6·05
Abbey Leix (Blandsfort)....	Queen's County..	52 56	7 17	532	3'94	4·93
Dublin (Fitz William Square)	Dublin.....	53 21	6 14	54	3'08	5·28
Mullingar (Belvedere).....	Westmeath.....	53 29	7 22	367	4'00	5·56
Cong (The Glebe).....	Mayo.....	53 33	9 16	112	4'70	3·58
Crossmolina (Enniscooe).....	Mayo.....	54 4	9 16	74	4'68	...
Collooney (Markree Obsy.)..	Sligo.....	54 11	8 27	127	4'30	5·93
Seaforde.....	Down.....	54 19	5 50	180	3'64	6·28
Bushmills (Dundarave).....	Antrim.....	55 12	6 30	162	4'06	5·57
Omagh (Edenfel).....	Tyrone.....	54 36	7 18	280	4'22	5·12

RAINFALL TABLE FOR AUGUST, 1912—continued.

RAINFALL OF MONTH (con.)					RAINFALL FROM JAN. 1.				Mean Annual 1875-1909.	STATION.
Diff. from Av. in.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1875-1909.	1912.	Diff. from Aver. in.	% of Av.		
		in.	Date.		in.	in.			in.	
+2.50	204	.72	25	25	15.92	19.31	+3.39	121	25.11	Camden Square
+3.81	258	.99	6	28	16.07	20.24	+4.17	126	27.64	Tenterden
+5.18	306	1.04	25	27	17.44	25.81	+8.37	148	30.48	Patching
+3.81	234	.56	26	29	18.58	25.40	+6.82	137	31.87	Cadland
+2.13	187	.61	6	20	15.47	22.01	+6.54	142	24.58	Oxford
+4.03	269	1.32	26	26	16.06	22.59	+6.53	141	25.17	Croyland Abbey
+1.60	192	1.47	25	20	11.47	12.97	+1.50	113	19.28	Shoeburyness
+5.77	329	2.83	26	24	15.96	21.76	+5.80	136	25.40	Westley
+5.34	342	3.61	26	23	14.20	20.28	+6.08	143	23.73	Geldeston
+6.38	302	1.37	5	27	21.79	34.24	+12.45	157	38.27	Polapit Tamar
+4.44	256	1.04	23	27	19.85	29.00	+9.15	146	33.54	Rousdon
+4.34	250	.85	28	29	18.73	33.07	+14.34	176	29.81	Stroud
+3.88	213	1.18	3	30	20.31	28.07	+7.76	138	32.41	Wolstaston
+3.66	230	1.04	26	25	18.16	28.63	+10.47	158	28.98	Coventry
+3.91	263	2.00	26	27	14.60	22.07	+7.47	151	23.35	Boston
+2.24	188	.94	26	21	15.70	24.96	+9.26	159	24.46	Hodsock Priory
+3.10	182	.99	23	25	21.93	25.42	+3.49	116	34.73	Macclesfield
+1.08	129	.74	23	24	19.61	26.31	+6.70	134	32.70	Southport
+ .18	103	.95	28	22	37.59	46.96	+9.37	125	61.49	Arncliffe
+2.59	193	.82	26	17	16.97	27.63	+10.66	163	26.87	Ribston Hall
+1.90	162	1.08	26	23	16.52	23.34	+6.82	141	26.42	Hull
+1.13	135	.47	1	29	17.65	23.19	+5.54	131	27.94	Newcastle
+1.28	111	1.43	17	28	76.76	83.05	+6.29	108	129.48	Seathwaite
+5.38	218	1.29	28	24	25.02	38.83	+13.81	155	42.28	Cardiff
+3.45	182	1.07	25	25	27.05	38.16	+11.11	141	46.81	Haverford west
+4.71	196	1.78	23	26	27.03	36.58	+9.55	135	45.46	Goggerddan
+2.39	176	.66	4	24	18.05	22.52	+4.47	125	30.36	Llandudno
+1.83	143	.84	4	25	26.49	35.26	+8.77	133	43.47	Cargen
+ .99	128	.90	4	20	21.22	20.83	— .39	98	33.76	Marchmont
+ .31	107	.74	19	24	29.37	32.93	+3.56	112	49.77	Girvan
+ .44	112	.85	4	22	22.04	22.29	+ .25	101	35.97	Glasgow
-1.71	72	1.12	5	20	40.06	39.83	— .23	99	68.67	Inveraray
-1.20	76	1.00	5	15	32.67	31.83	— .84	97	56.57	Quinish
+ .57	117	.95	4	21	18.20	18.22	+ .02	100	28.64	Dundee
+ .89	124	...	...	...	21.43	23.03	+1.60	108	34.93	Braemar
+2.27	174	1.01	4	20	20.09	21.27	+1.18	106	32.73	Aberdeen
+1.38	145	.93	20	19	18.70	17.29	-1.41	92	29.33	Cawdor
- .13	96	.79	20	21	26.72	24.77	-1.95	93	44.53	Fort Augustus
- .82	88	.97	29	21	49.51	44.28	-5.23	89	83.93	Bendamph
+3.67	235	1.29	4	18	19.90	22.32	+2.42	112	31.90	Dunrobin Castle
+2.24	182	.96	8	21	18.11	20.78	+2.67	115	29.88	Wick
+1.49	133	1.29	7	28	32.97	38.27	+5.30	116	54.81	Killarney
+ .95	125	.85	3	25	24.26	32.83	+8.57	135	39.57	Waterford
- .60	85	1.20	22	22	24.57	27.72	+3.15	113	39.43	Castle Lough
+ .53	111	1.38	23	29	27.28	33.63	+6.35	123	45.11	Miltown Malbay
+2.74	182	1.43	2	24	21.63	34.54	+12.91	160	34.99	Courtown Ho.
+ .99	125	.73	22	27	22.77	28.46	+5.69	125	35.92	Abbey Leix
+2.20	171	1.46	4	23	17.83	22.10	+4.27	124	27.68	Dublin
+1.56	139	.82	4	27	23.17	30.35	+7.18	131	36.15	Mullingar.
-1.12	76	1.01	22	21	29.83	30.01	+ .18	101	48.90	Cong
...	...	...	...	...	31.32	...	...	...	52.87	Enniscoe
+1.63	138	1.00	22	24	26.49	31.78	+5.29	120	42.71	Markree
+2.64	172	2.06	4	20	24.38	34.77	+10.39	143	38.91	Seaforde
+1.51	137	1.00	28	22	22.83	26.08	+3.25	114	37.56	Dundarave
+ .90	121	1.10	4	21	24.66	30.64	+5.98	124	39.38	Omagh

SUPPLEMENTARY RAINFALL, AUGUST, 1912.

Div.	STATION.	Rain inches	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	6·15	XI.	Lligwy	4·27
„	Ramsgate	5·76	„	Douglas	5·17
„	Hailsham	6·45	XII.	Stoneykirk, Ardwell House...	4·67
„	Totland Bay, Aston House...	5·80	„	Dalry, The Old Garroch.....	5·29
„	Stockbridge, Ashley..	7·05	„	Langholm, Drove Road	5·93
„	Grayshott	6·08	„	Beattock, Kinnelhead	4·87
„	Caversham, Rectory Road ...	4·84	XIII.	St. Mary's Loch, Cramilt Ldge	4·94
III.	Harrow Weald, Hill House...	5·52	„	North Berwick Reservoir.....	5·24
„	Pitsford, Sedgebrook.....	6·96	„	Edinburgh, Royal Observaty.	4·75
„	Woburn, Milton Bryant.....	6·69	XIV.	Maybole, Knockdon Farm ...	2·87
„	Chatteris, The Priory.....	7·66	XV.	Campbeltown, Witchburn ..	6·10
IV.	Colchester, Lexden	5·22	„	Holy Loch, Ardnadam.....	5·40
„	Newport	5·64	„	Ballachulish House	4·13
„	Ipswich, Copdock	6·11	„	Islay, Eallabus	4·45
„	Blakeney	8·67	„	Tirie, Cornaigmore	3·66
„	Swaffham	7·22	XVI.	Dollar Academy	4·94
V.	Bishops Cannings	5·45	„	Balquhidder, Stronvar.....	4·70
„	Winterbourne Steepleton.....	8·50	„	Coupar Angus	3·34
„	Ashburton, Druid House.....	10·35	„	Glenlyon, Meggernie Castle..	4·27
„	Cullompton	7·09	„	Blair Athol	3·27
„	Lynmouth, Rock House	9·59	„	Montrose, Sunnyside Asylum.	3·70
„	Okehampton, Oaklands.....	10·44	XVII.	Alford, Lynturk Manse	6·10
„	Hartland Abbey.....	7·66	„	Fyvie Castle	5·97
„	Probus, Lamellyn.....	10·92	„	Keith Station	6·72
„	North Cadbury Rectory.....	6·66	XVIII.	Skye, Dunvegan	4·36
VI.	Clifton, Pembroke Road.....	8·38	„	N. Uist, Lochmaddy	3·33
„	Ross, The Graig	6·18	„	Glenquoich, Loan.....	8·15
„	Shifnal, Hatton Grange.....	5·45	„	Alvey Manse.....	3·75
„	Droitwich.....	7·68	„	Loch Ness, Drumnadrochit...	4·62
„	Blockley, Upton Wold.....	8·60	„	Glencarron Lodge	6·17
VII.	Market Overton.....	5·52	XIX.	Invershin	5·08
„	Market Rasen.....	5·31	„	Loch Stack, Ardochullin	9·42
„	Bawtry, Hesley Hall	4·82	„	Melvich	5·22
„	Derby, Midland Railway.....	6·12	XX.	Skibbereen Rectory	3·76
„	Buxton	8·64	„	Dunmanway, The Rectory ..	4·36
VIII.	Nantwich, Dorfold Hall	4·97	„	Glanmire, Lota Lodge.....	3·67
„	Chatburn, Middlewood	6·50	„	Mitchelstown Castle.....	4·53
„	Cartmel, Flookburgh	6·84	„	Darrynane Abbey.....	5·12
IX.	Langsett Moor, Up. Midhope	7·02	„	Clonmel, Bruce Villa	3·59
„	Scarborough, Scalby	4·24	„	Newmarket-on-Fergus,Fenloe	...
„	Ingleby Greenhow	4·60	XXI.	Laragh, Glendalough	9·19
„	Mickleton	4·80	„	Ballycumber, Moorock Lodge	3·75
X.	Bellingham, High Green Manor	5·63	„	Balbriggan, Ardgillan	6·21
„	Ilderton, Lilburn Cottage ...	5·16	XXII.	Woodlawn	3·94
„	Kewick, The Bank.....	5·86	„	Westport, St. Helens	3·57
XI.	Llanfrecfa Grange	8·49	„	Achill Island, Dugort	4·08
„	Treherbert, Tyn-y-waun	17·08	„	Mohill, The Rectory	5·35
„	Carmarthen, The Friary	8·72	XXIII.	Enniskillen, Portora.....	...
„	Castle Malgwyn [Llechryd]...	6·39	„	Dartrey [Cotehill]	5·53
„	Crickhowell, Tal-y-maes	11·00	„	Warrenpoint, Manor House ..	7·24
„	New Radnor, Ednol	6·86	„	Banbridge, Milltown	5·75
„	Rhayader, Tyrmynydd	11·70	„	Belfast, Cave Hill Road	6·69
„	Lake Vyrnwy	6·53	„	Glendarm Castle.....	5·68
„	Llangyhanfal, Plás Draw.....	4·91	„	Londonderry, Creggan Res...	4·71
„	Dolgelly, Bryntirion.....	...	„	Killybegs	6·03
„	Bettws-y-Coed, Tyn-y-bryn...	6·00	„	Horn Head	4·88

METEOROLOGICAL NOTES ON AUGUST, 1912.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow; F for number of days Frost in Screen; f on Grass.

LONDON, CAMDEN SQUARE.—The wettest August since 1881, and the wettest of all months since October, 1903. Temp. was persistently low, the mean temp., $57^{\circ}\cdot9$, being $4^{\circ}\cdot4$ below the average, and the lowest for August in the 55 years' record. Not since April, 1911, had the mean temp. of the month been below the average. Duration of sunshine $106\cdot5^*$ hours. Duration of R $66\cdot2$ hours, and the greatest recorded in August in the past 32 years. Evaporation $1\cdot69$ in. Shade max. $73^{\circ}\cdot2$ on 4th; min. $43^{\circ}\cdot1$ on 28th. F 0, f 0.

TENTERDEN.—The wettest August in 50 years. Duration of sunshine $145\cdot0^{\dagger}$ hours. Shade max. $70^{\circ}\cdot0$ on 4th; min. $42^{\circ}\cdot0$ on 3rd. F 0, f 0.

TOTLAND BAY.—The heaviest August R in 26 years, and mean temp., $57^{\circ}\cdot6$, the lowest in that time. Duration of sunshine $123\cdot4^*$ hours. Shade max. $67^{\circ}\cdot6$ on 31st; min. $44^{\circ}\cdot2$ on 3rd. F 0, f 1.

PITSFORD.—A month of almost constant gloom and R. Temp. much below, and R $5\cdot09$ in. above the average. Shade max. $70^{\circ}\cdot4$ on 4th; min. $38^{\circ}\cdot0$ on 12th.

BURY ST. EDMUNDS.—The greatest August R since observations began in 1856, and the most disastrous harvest known here. Shade max. $70^{\circ}\cdot0$ on 4th; min. $42^{\circ}\cdot5$ on 12th. F 0, f 0.

POLAPIT TAMAR.—Cold, sunless month, with the greatest August R in the past 43 years. Shade max. $62^{\circ}\cdot9$ on 29th, 30th and 31st; min. $34^{\circ}\cdot4$ on 3rd. F 0, f 0.

NORTH CADBURY.—By far the coldest, cloudiest and wettest August in the 16 years' record. Shade max. $74^{\circ}\cdot0$ on 29th; min. $40^{\circ}\cdot0$ on 3rd. F 0, f 0.

DROITWICH.—Heavy R and H from 3.2 to 3.12 p.m. on 8th, at the rate of 5.34 in. per hour. Shade max. $71^{\circ}\cdot0$ on 4th; min. $36^{\circ}\cdot0$ on 28th. F 0, f 0.

HODSOCK PRIORY.—Shade max. $67^{\circ}\cdot6$ on 8th; min. $37^{\circ}\cdot5$ on 3rd. F 0, f 0.

SOUTHPORT.—Duration of sunshine $119\cdot3^*$ hours, and of R $96\cdot0$ hours. Evaporation $2\cdot30$ in. Mean temp. $55^{\circ}\cdot4$, or $3^{\circ}\cdot7$ below the average. Three waterspouts over the sea on morning of 13th. Shade max. $67^{\circ}\cdot0$ on 4th; min. $42^{\circ}\cdot0$ on 3rd. F 0, f 0.

HULL.—Dull, cold and cheerless, with persistent R, and only $52\cdot0^*$ hours of sunshine. Shade max. $68^{\circ}\cdot0$ on 16th, 17th and 29th; min. $41^{\circ}\cdot0$ on 3rd. F 0, f 0.

HAVERFORDWEST.—Very wet and with low night temps. Hay and corn crops ruined by the wet. Duration of sunshine $96\cdot6^*$ hours. Shade max. $65^{\circ}\cdot1$ on 10th; min. $37^{\circ}\cdot7$ on 3rd.

LLANDUDNO.—Shade max. $65^{\circ}\cdot0$ on 17th; min. $43^{\circ}\cdot0$ on 28th.

CARGEN.—The greatest number of rain days, the least sunshine, the lowest mean max. temp., and the lowest bar. for August in the record. Shade max. $66^{\circ}\cdot0$ on 8th; min. $35^{\circ}\cdot0$ on 3rd.

EDINBURGH.—Shade max. $64^{\circ}\cdot1$ on 16th; min. $41^{\circ}\cdot2$ on 3rd. F 0, f 0.

COUPAR ANGUS.—Persistent light R and cold sunless days. The mean temp., $54^{\circ}\cdot5$, was about $3^{\circ}\cdot0$ below the average, and ruinous to the fruit crops. Shade max. $66^{\circ}\cdot5$ on 18th; min. $34^{\circ}\cdot0$ on 26th.

DRUMNADROCHIT.—The R was only exceeded in August, 1889, and August, 1894. Remarkable continuance of N. and E. winds.

LOCH STACK.—Duration of sunshine, $75\cdot5^*$ hours.

GLANMIRE.—Harvesting and other agricultural operations have been seriously hampered by the wet.

DUBLIN.—A cloudy, cold, and wet month. Mean temp. $54^{\circ}\cdot4$, or $5^{\circ}\cdot3$ below the average. Shade max. $65^{\circ}\cdot9$ on 16th; min. $42^{\circ}\cdot9$ on 2nd. F 0, f 0.

OMAGH.—A cold wet month with a deficiency of sunshine. The main hay crop has been irretrievably damaged.

* Campbell-Stokes.

† Jordan.

Climatological Table for the British Empire, March, 1912.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
London, Camden Square	62·3	25	32·6	21	53·3	40·5	41·8	86	108·7	29·9	2·84	20	7·6
Malta	70·2	3	47·9	24	64·3	53·6	51·5	83	135·0	..	·84	9	4·6
Lagos	93·5	12	74·5	25	90·9	77·8	74·8	71	164·0	72·5	·20	2	...
Cape Town	98·9	18	44·0	26	79·9	60·0	57·6	67	...	...	·76	5	2·9
Durban, Natal	86·1	3	57·8	10	80·6	65·8	66·4	73	143·5	...	3·72	14	5·1
Johannesburg	82·0	9	40·7	11	73·0	53·8	52·3	73	148·5	39·2	2·58	13	4·1
Mauritius	86·7	29	67·5	8	83·8	72·6	70·3	78	157·3	60·8	2·92	18	5·4
Bloemfontein	88·1	9	42·6	27	80·8	67·6	51·3	64	...	...	1·19	7	3·0
Calcutta	98·9	13	60·2	31	91·8	70·4	66·4	65	...	55·9	4·09	7	2·2
Bombay	92·3	30	69·3	8	87·1	73·2	69·0	70	133·5	62·9	...	...	1·2
Madras	94·9	22	68·3	17	91·7	74·3	72·8	76	139·9	64·4	·00	0	1·3
Kodaikanal	75·8	28	45·3	11	69·7	52·2	45·6	62	150·8	38·0	1·14	6	3·8
Colombo, Ceylon	92·2	9	74·0	9	89·8	76·4	72·9	73	159·6	65·9	2·07	7	4·0
Hongkong	80·3	29	48·9	17	67·9	60·6	60·8	86	123·2	...	4·35	11	9·1
Sydney	88·5	24	56·5	22	75·6	63·3	59·7	72	146·0	47·3	8·68	27	5·9
Melbourne	93·9	4	45·0	7	75·4	56·5	53·0	64	147·5	39·9	·74	10	5·0
Adelaide	101·0	3	49·3	14	82·9	60·2	54·1	53	157·9	40·0	·67	5	3·7
Perth	102·2	11	53·7	26	81·9	61·4	57·7	62	159·0	47·1	·06	6	3·2
Coolgardie	105·2	18	54·3	7	88·6	63·2	58·0	54	161·6	54·0	1·21	6	3·6
Hobart, Tasmania	88·2	3	45·1	15*	67·1	52·5	48·1	64	137·2	38·7	2·23	12	6·5
Wellington	75·2	7	43·0	17	63·7	52·7	47·4	68	119·0	33·0	2·89	14	6·6
Auckland	78·0	3	49·0	11	67·8	56·0	57·8	87	135·0	45·0	6·12	16	6·7
Jamaica, Kingston	88·5	16	67·1	2	86·5	69·5	68·2	78	...	...	·56	4	3·8
Grenada	87·0	31	72·0	4, 29	83·0	74·0	...	71	140·0	...	1·09	14	3·0
Toronto	48·7	19	4·0	3	33·6	18·0	...	...	119·2	1·0	1·97	8	3·7
Fredericton	49·0	16	-13·0	6	35·9	14·6	...	81	...	...	4·70	10	5·5
St. John, N.B.	49·2	20	3·3	5	35·4	22·0	...	...	...	...	3·64	15	5·6
Edmonton, Alta.	55·8	26	-17·7	1	34·5	9·3	...	65	113·5	-20·8	·32	5	1·9
Victoria, B.C. ... ..	...	...	...	...	50·7	34·4	...	72	...	...	1·43	9	4·0

* And 25.

MALTA.—Mean temp. of air 58°·1. Average sunshine 8·4 hours per day.

Durban, Natal.—Rainfall 1·09 in. below 35 years' average.*Johannesburg.*—Bright sunshine 222·2 hours.*Mauritius.*—Mean temp. of air 0°·2 above, R 6·40 in. below, averages. Mean hourly velocity of wind 10·4 miles, or 1·0 above average.

KODAIKANAL.—Bright sunshine 222 hours.

COLOMBO.—Mean temp. of air 83°·1, or 1°·1 above, R 2·21 in. below, averages. Mean hourly velocity of wind 4·3 miles. TSS on 6 days.

HONGKONG.—Mean temp. of air 64°·3. Bright sunshine 104·6 hours.

Sydney.—Mean temp. of air 0°·3 above, and R 3·54 in. above, averages.*Melbourne.*—Mean temp. of air 1°·2 above, and R 1·47 in. below, averages.*Adelaide.*—Mean temp. of air 1°·7 above, and R 47 in. below, averages.*Coolgardie.*—Mean temp. of air 4°·6 above average.*Wellington.*—Mean temp. of air 2°·2 below, and R 57 in. below, averages.