

# S Y M O N S'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

CXL.]

SEPTEMBER, 1877.

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### THE BRITISH ASSOCIATION AT PLYMOUTH.

WE cannot report that the recent meeting of the British Association was a success in any respect. It was equal to the average in the attendance of honoured and well known members from distant points, in all other respects it was below it. Notably as regards the interest taken in the proceedings by the residents in the three towns and the surrounding districts. Out of the last twenty annual meetings, we recollect only one, viz., Oxford, in 1859, at which the local contingent was weaker. We believe the following includes all the Meteorologists at the meeting, and the breakfasters were only those marked by an asterisk :—

Adams, Prof. J. C., F.R.S. Cambridge.	Herschel, Prof. A. S. .... Newcastle-on-Tyne
Barham, Dr. C. .... Truro.	Jackson, M. .... Ramsgate.
*Black, Surgeon-Major .... Edinburgh.	Lake, Dr. W. C. .... Teignmouth.
Chambers, C., F.R.S. .... Bombay.	*Latham, Baldwin, C.E. .... London.
Chapman, Dr. T. A. .... Hereford.	*Lonsdale, N. L. .... Clifton.
*Clapp, F. .... Exeter.	*Lowe, E. J., F.R.S. .... Nottingham.
*Crawford, W. C. .... Glasgow.	Merrifield, J., Ph. D. .... Plymouth.
Deacon, G. F., C.E. .... Liverpool.	*Muirhead, Dr. H. .... Cambuslang.
Dimond-Churchward, Rev. Bideford.	Pengelly, W., F.R.S. .... Torquay.
*Dines, G. .... Walton-on-Thames	Prior, R. C. A. .... Taunton.
*Dymond, E. E. .... Woburn.	Reade, T. M., C.E. .... Liverpool.
Everett, Prof. J. D. .... Belfast.	Smelt, Rev. M. A. .... Cheltenham.
Evans, J., F.R.S. .... Hemel Hempstead.	*Smith, D. .... Birmingham.
*Field, Rogers, C.E. .... London.	*Smyth, J., junr., C.E. .... Banbridge.
Fox, G. .... Kingsbridge.	Sopwith, T., F.R.S. .... London.
Galton, F., F.R.S. .... London.	*Symons, G. J. .... „
Glaisher, J., F.R.S. .... Blackheath.	Taylor, T. .... Aston Rowant.
*Harrison, J. P. .... Norwood.	Talmage, C. G. .... Leyton.
Header, W. .... Torquay.	Vivian, E. .... Torquay.
Hennessey, Prof. H., F.R.S. Dublin.	Woodward, C. J. .... Birmingham.

Professor EVERETT read the report of the Committee on

#### UNDERGROUND TEMPERATURE.

The observations conducted under the auspices of this committee were intended to determine the rate at which temperature increases as we go deeper into the earth. They were sometimes made by lowering self-registering thermometers into deep bores or artesian wells, sometimes by placing thermometers in holes bored in mining galleries, leaving the thermometer there for a considerable time,

and then taking them out and reading them. The contributions the committee had to make this year were from three different places. Observations on a very elaborate scale had been received from the important mining district of Schemnitz in Hungary. A request for observations was sent in 1873 to the Imperial School of Forests and Mines, and a committee was formed. Dr. Otto Schwartz, Professor of Physics and Mathematics, undertook the leading part in the work of the committee. His observations gave the following results:—No. 1 shaft, an increase of  $1^{\circ}$  Fahrenheit for every 89.5 feet; No. 2,  $1^{\circ}$  for 72 feet; No. 3,  $1^{\circ}$  for 64.2 feet; No. 4,  $1^{\circ}$  for 55.2 feet; No. 5,  $1^{\circ}$  for 93.2 feet, showing a mean increase of  $1^{\circ}$  for every 75.5 feet. The best mode of combining these results was to compare the sum of the depths with the sum of the increments of temperature. They thus had a total increase of  $68^{\circ}.9$  in 5207 feet, at the rate of  $1^{\circ}$  F. in  $7^{\circ}.5$  feet. Comparing the deepest with the shallowest temperatures (as a check on the assumed surface temperature) it was found that the mean increase was  $1^{\circ}$  in 72.5 feet. The mean of the two results was  $1^{\circ}$  in 74 feet. The rocks consisted for the most part of trachyte and greenstone. Thanks was due to M. Antoine Peck, Ministerial Councillor and Director of the Mines, and to Herr Ed. Pörchl, Director of the School, for energetic co-operation in this extensive and valuable series of observations. The next series of observations were made by Mr. Matthew Heckels, Manager of Boldon Colliery, near Newcastle, in holes bored upwards to a distance of 10 feet from some of the deepest seams. The mine was perfectly dry, and where the observations were made free from currents of air. The results of these observations was an increase of  $31^{\circ}$  F. for a depth of 1,514 feet, at the rate of  $1^{\circ}$  in 49 feet. The conditions under which they were made rendered them extremely valuable. Observations had been also received for the first time from India. They were taken by Mr. H. B. Medlicott, M.A., of the Geological Survey, in bores made in search of coal, at places called Khappa, Manegaon, and Moran, and have been published by him in the "Records of the Geological Survey of India," vol. x. Only the observations at Manegaon were entirely satisfactory. It was apparent from those that the influence of excessive summer heat reached to a considerable depth. The increase from 60 feet downwards was remarkably uniform, and the whole increase from this depth to the lowest reached, was  $3^{\circ}.7$ , at the rate of  $1^{\circ}$  Fahrenheit for 68 feet.

Dr. BARHAM, of Truro, read a note on—

#### SOME RELATIONS OF SEA AND LAND TEMPERATURE IN THE SOUTH WEST OF ENGLAND.

The purpose of the note was to furnish some materials for a correct estimate of the reciprocal influence of land and sea on the temperature of the air in the South West of England, and inferentially on that of the more eastern districts. The physical geography of the promontory of Cornwall and the Scilly Isles rendered them interesting for their meteorology, and also as a scientific instrument from Nature's workshop, hardly to be equalled elsewhere for displaying, and to some extent measuring, the operation of most of the factors of climate. The stations of observation were St. Mary's (Scilly), Penzance, Helston, St. Agnes, Truro, Plymouth, Guernsey, and Greenwich, the latter as a generally recognised central standard. The observations extended over four years. The mean highest temperature was the same at Scilly and Penzance, namely  $71^{\circ}$ ; at Guernsey, which came next, it rose to  $72^{\circ}.7$ ; at Helston it approached  $79^{\circ}$ ; at Truro it was nearly  $78^{\circ}$ ; and at Plymouth  $74^{\circ}$ . The mean lowest temperatures were St. Mary and Penzance, again almost the same— $59^{\circ}$ ; Guernsey,  $61^{\circ}$ ; Truro,  $56^{\circ}.8$ ; at Greenwich,  $55^{\circ}$ . The absolute highest temperature at Scilly and Penzance was again much alike, namely,  $74^{\circ}$  and  $75^{\circ}$ ; Helston and Truro,  $86^{\circ}$  and  $85^{\circ}$ ; Guernsey,  $78^{\circ}.5$ ; while at Greenwich it reached  $91^{\circ}.8$ ; so that there was a difference of  $16^{\circ}$  between the extremes of Scilly and Greenwich, and of  $12^{\circ}$  between places almost adjacent, as Penzance and Helston. The absolute lowest summer temperature showed a similar relative equability. With regard to sea temperature, it was stated that the mean temperature of surface water at Scilly and around the Cornish coast at the height of summer was  $60^{\circ}$ . Its influence was well shown in

abstracting more than  $8^{\circ}$  from the average heat of hot days in the ten miles between Helston and the shores of Mount's Bay. There was scarcely any difference between Penzance and Scilly in consequence of the almost island character of the peninsula; but, immediately they got beyond the estuary, they got to a mainland climate, Helston being much hotter in summer and much colder in winter. That was the great reason why Penzance was so suitable as a health resort; its climate, though not identical with that of Scilly, having still a great analogy to it. The extreme cold recorded at Penzance during 50 years was  $23^{\circ}$ ; occasionally, but very rarely, it fell to  $26^{\circ}$ ; and at Scilly it was rarely below  $29^{\circ}$ . The mean temperature of the sea in the winter months was  $50^{\circ}$ ; and this, it was seen, moderated the extreme of cold in winter in the same way as it did the extreme of heat in summer. In the course of further observations, Dr. Barham showed how much farther inland the influence of the westerly winds extended than that of the east winds. He also pointed out that inasmuch as the growth of early vegetables was one of the staples of the district, the absence of frost was of the highest importance, and that for this purpose records of the minimum temperature on grass were essential. He regretted that such observations were not made in the district.

Mr. GLAISHER said the most important part of the paper was that referring to the action of the sea temperature on land climates. For a long time he had tried in vain to obtain sea temperatures for a consecutive number of years, and he was glad that Dr. Barham had secured observations for three years. He was inclined to think that the differences of temperature at various stations exhibited in the paper were greater than were entirely due to the influence of the sea. There was no doubt, however, that the sea climate all round the coast of England prevented high temperature by day and low temperature at night. He saw no reason why the heat radiation by night should not be the same at Scilly as at any other place, under the same atmospheric conditions.

Mr. SYMONS seconded Mr. Glaisher's appeal for more information on the subject of sea temperature. Financially this would be of the utmost importance. The catch of fish depended greatly upon the temperature of the sea; and if they could give fishermen some information on this head, they would know where to go for the fish, we should have better catches, and the food supply from that source would be greatly increased. This was a practical illustration of the utility of meteorology. He regretted that Dr. Barham's materials were not equal in value to the skill with which he had worked them up. Unless there had been a great improvement at one or two of the stations, he was inclined to think that some of the differences which had been set down to physical geography were really due not to the position of the station, but to the position of the instruments used. Until all the instruments were placed in good open spots, it would always be very difficult to compare the climate of one locality with that of another. With regard to Mr. Glaisher's remark on terrestrial radiation, it struck him that it would be much greater in districts where the air was dry than where it was moist, as in the West of England. The difference between Helston and Penzance was, he thought, due partly to the position of the instruments. The one essential in meteorology was to get the instruments accurately compared in the first instance, and then to have them placed in proper positions, as open as could be obtained.

Mr. DINES thanked Dr. Barham for his valuable paper, and asked in what way the temperature of the sea was taken, whether near the surface or below? He should expect much less radiation at the Scilly Isles than at Greenwich.

Dr. BARHAM, in his reply, said he thought there had been a great improvement at Helston in the instruments used, and in their modes of exposure; and he had no doubt they could place every confidence in the accuracy of the observer. The observations of sea temperature were made about a mile from land with every precaution against errors. The water tested was brought up from a depth of six or eight feet. Dr. Dymond, of the Falmouth Observatory, had done this work with scrupulous accuracy. The sea temperature at the Scilly Islands was very little different from that at Falmouth.

## PLYMOUTH METEOROLOGY.

Dr. MERRIFIELD read a paper on "The Meteorology of Plymouth," the result of consecutive observations taken daily at eight a.m. during the twelve years, 1865 to 1876 inclusive. The barometer showed the average pressure for the year to be 29·945 inches. The months of greatest pressure were June 30·059 and July 29·996; of least pressure January and October, both being 29·868. Thus there was an average annual range of ·191 inch. The two former months corresponded to those of small rainfall; the two latter to those of great rainfall. A table annexed showed that the greatest ranges corresponded with the least pressure, and *vice versa*. Dr. Merrifield said he would leave it to his medical friends to discover whether great ranges of atmospheric pressure, independent of temperature, had any effect on persons suffering from diseases of the respiratory organs and of the heart.

*Temperature*.—The coldest month was January, the average for that month being 42°·8, half a degree lower than December; but the nights of March were colder than those of February, and almost as cold as those of December and January. The hottest month was July, whose average was 63°·6, about 1° higher than August. There was a mean annual range of 20°·7, while the difference between the average maximum and minimum for the year was only 13°·5. Some years there was more than double the annual range. Extreme readings, as in all the south-west district, were exceedingly rare. The maximum temperature in the shade was 93° on June 27th, 1866; the minimum was 14° on December 27th, 1869. The mean temperature was 52°·0. From the reports of the British Association, he found that the average temperature from 1833 to 1837 was 52°·1, agreeing within one-tenth of a degree with what he had deduced.

*Wet and dry bulbs*.—The greatest difference between the wet and dry bulbs was in June, 3°·8; and July, 3°·6; the former was also the driest month as well as having the least number of rainy days. The least difference was in December and January, ·9; and these were two of the three months of greatest rainfall and greatest number of rainy days. Only few days in the year were without cloud or mist.

*Rainfall*.—The month of the greatest rainfall, 4·852 in., was in January, corresponding with that of the greatest number of rainy days, viz., 21; the month of least rainfall also corresponded with that of the least number of rainy days, viz., June, 1·375 in. in 9½ days. Leaving out thunder showers, the month of September was the month of heaviest rains. Some months, as February, October, and November, seemed to have a great number of rainy days, with drizzle nearly the whole time; and June and April had rain of least violence. There was nearly twice as much rainfall in the six months from September to February (inclusive) as during the remaining six months, while the number of rainy days was almost as three to two. The heaviest shower he had witnessed was on July 29th, 1871, when ¾ in. fell in less than half an hour. Although so near the sea, and in the path of the counter trades, Plymouth sometimes, though rarely, suffered from want of rain. Being sheltered, his rain gauge showed about 20 per cent. less than that shown by other gauges in the neighbourhood at about the same elevation above the ground. The predominant winds were westerly, there being 195 westerly to 144 easterly. Winds of the greatest violence occurred in November, December, and January, and always veered from about S.S.W. to N.W., when they gradually declined, the greatest force being from about W.S.W. Judging from newspaper reports, thunderstorms were fewer and less violent than further north and east. No doubt a larger portion of the atmospheric electricity generated by the evaporation and friction of the waters of the sea was silently discharged through the damp atmosphere, and thus eluded observation.

Mr. SYMONS observed that no doubt Dr. Merrifield had done all that it was possible for man to do with the instruments and position at his service. Being in Plymouth, it was only right that, as a worker in meteorology, he should say something about an organisation which existed in that town in connection with one of the local newspapers. The editor of this paper—the *Western Morning News*—took the trouble to send post cards to numerous observers throughout Devon, and and Cornwall, requesting returns; those were duly forwarded to the office of the paper, edited in the office, and printed in the paper. This kind of

thing was done in only two or three other counties in England ; and, as far as he knew, the *Western Morning News* was the only paper undertaking not only the printing, but the scientific editing of meteorological notes. It was only due, therefore, that they, as members of a scientific association, should acknowledge the valuable services rendered to the science of meteorology by that paper. (Applause).

### THE HEIGHT OF CLOUDS.

Mr. A. MALLOCK read a paper "On the Measurement of the Height of Clouds," describing a method adopted by him in which photographs of the same cloud are taken from different points, and a calculation made from the difference of the angles.

The Chairman (Prof. G. C. Foster) was of opinion that if the method were used systematically at the public observatories, much useful information might be obtained.

The following paper, by Mr. G. DINES, was then read by Mr. G. J. SYMONS—

### DIFFERENCE OF RAINFALL WITH ELEVATION.

In the year 1776 a rain gauge was placed upon the roof of Westminster Abbey by Dr. Heberden, which was found to collect much less rain than a similar gauge placed upon the ground. All subsequent observations have given the same results, and the fact that such difference exists will be admitted as beyond dispute.

Many discussions upon the cause of this difference have arisen from time to time, notably that in the *Meteorological Magazine* for 1871 ; and although the idea has been gradually gaining ground that the difference in the amount collected is caused by the wind, yet no general agreement upon the subject has yet been come to ; and this must be my apology for the introduction of the present paper.

A season of comparative leisure has given me the long-wished-for opportunity of investigating this subject ; and a tower easy of access, and attached to my residence, has enabled me to compare the amount of rain collected there with that upon the ground.

The gauge placed at the top of tower is 5 inches in diameter, 1 foot above the parapet, 50 feet above ground, and 101 feet above Ordnance datum. The lower gauge is 8 inches in diameter, 4 feet above the ground, and 54·54 feet above the same datum. Other gauges were used at the same time, and these were shifted occasionally into different positions for the purpose of experiment ; but the two above-named have been considered as standards to refer to, and still remain in the same position. The measuring glasses were of small diameter, so that the rainfall could be measured to the one-thousandth part of an inch with tolerable accuracy ; they were generally read off at the end of a shower, and not at fixed times only. Without going into details, the amount collected from August 1st, 1876, to August 1st, 1877, was—in the upper gauge, 24·60 inches ; in the lower gauge, 31·30 inches, the proportion for the twelve months being as 100 in the upper gauge to 127 in the lower one. In cases of high wind with fine rain, the amount collected in the lower gauge has been from two to three times as much as in the upper one. This was the case on several days in January last. On the other hand, with heavy rain and no wind, the amount collected in the upper gauge has been equal to, or in excess of, that of the lower one ; but this does not occur very frequently.

A large rain-water cistern attached to the house, and easily closed so as to prevent the egress of water, has enabled me to compare the amount of rain collected from a large slated roof with that which falls in the gauges, one inch of rain upon the roof (which runs very freely before the one-hundredth part of an inch has fallen) being equal to 16·77 inches in the cistern. As a rule, the amount of rain collected from the roof gives the fall at something between that of the two gauges ; but on several occasions in very windy weather the amount collected in the cistern made the fall upon the roof greater than given by any of the gauges. In

no single observation has the fall upon the roof been exceeded by that in the upper or 5 in. gauge.

The temperature of the rain has been supposed to have some influence upon the question. This was therefore taken in order to compare it with that of the dew point; but an unexpected difficulty occurred. The observations made upon what may be called pelting showers led to the conclusion that the temperature of the rain is *sensibly* increased by the stoppage of its motion; and how to get at the true temperature of the rain without interfering with its motion is still a difficulty.

Speaking generally, the temperature of the rain appears to be in excess of that of the dew point. When this is the case, the rain-drop, on its way to the earth, must diminish by evaporation, and in that way make the rain less in amount as it approaches the ground. The author, however, feels assured, from the best calculation he can make, that the difference from this cause would not amount to 1 per cent.; and the temperature of the rain may therefore be left out of consideration in dealing with this question.

These observations, continued for several months, and at every possible opportunity, appear to show that the difference of 27 per cent. in the amount of rain collected, is due to the wind at the higher level, causing an eddy about the rain gauges, and so turning aside the rain-drops, *and not to any deficiency in the amount of rainfall at the higher level.*

Such was the conclusion come to in my own mind; but looking to the long and almost angry controversies that had taken place upon this question, I felt that the additional evidence I could adduce was not sufficient to force the same conclusion upon the minds of others.

In this state of affairs, Mr. Symons's *British Rainfall* for 1876 came to hand; and after reading his remarks upon this subject (see page 37), a gauge of 24 inches in diameter was placed upon the top of the tower near to the 5-inch. The amount collected by that gauge since its erection, compared with the others, has been as follows:—

	inches.
5 in. gauge on tower ... ..	3·18 or as 100
24 in. gauge on tower ... ..	3·56 to 112
8 in. near ground ... ..	3·82 to 120

On several occasions the rain collected in the large gauge has been from 30 to 50 per cent. greater than that collected by the 5 in. gauge at the same level, and at the same time, equal to, or a little in excess of, that given by the 8-inch near the ground.

Before composing this paper, I should have much preferred a longer time for the continuance of observations with the 24-inch gauge; but the few already made are so decided in their character, as to induce me to take the earliest opportunity of calling the attention of meteorologists to the subject, in order that others may take action in the matter, and, if possible, decide the question, which, so long as it remains an open one (speaking for myself only), will be a standing disgrace to meteorologists.

Sir WM. THOMSON followed with a paper on the

#### VARIATIONS OF BAROMETRIC PRESSURE,

in which he urged that to avoid the publication of voluminous returns and vast accumulations of books of reference, the results of all meteorological observations should be given out by harmonic analysis. He knew this was a somewhat arbitrary law, but with such a vast accumulation of results printed in bulky form, which it was often difficult to get at, and which were very seldom referred to in consequence, it was becoming absolutely necessary that these results should, as they easily could, be given in the way he indicated.

A paper by Mr. C. MELDRUM was read

#### ON THE DIURNAL VARIATIONS OF THE BAROMETER AND WIND IN MAURITIUS.

Mr. Meldrum remarked that in 1875, 1876, and 1877, the number of cyclones had been much below the average, and that there had not been any one great

storm such as that which occurred in the periods 1860-63, and 1870-73. This, so far, confirms the hypothesis of a connection between the frequency of sunspots and the frequency of cyclones.

With regard to the rainfall the evidence in favour of a cycle corresponding with the sunspot cycle has much increased. Dr. Hunter, of Calcutta, has lately found for Madras a rainfall cycle identical with that which the author had previously found both for India and various other parts of the world. Mr. Meldrum has recently discussed the rainfalls of thirteen stations in the French colonies for various periods from 1832 to 1872, and obtained results nearly the same as those that had been found for 144 stations scattered over both hemispheres. Dr. Fritz, of Zurich, has shown that the severest hailstorms and the highest levels of the rivers occur in the years of maximum sunspot. In short there can, he thinks, be little doubt of an eleven-year rainfall cycle, and when its laws are known they will probably be of much practical use.

### LUMINOUS METEORS.

MR. J. GLAISHER read the report of the committee on "Luminous Meteors," which continued the record of a year of very active research, though the principal object the committee had in view—that of furnishing observers with a *résumé* of star showers and meteor systems, occasional and periodical, during recent years, such as would serve as a guide for the future—had to be postponed. The autumn and winter months were marked by numerous large fireballs in England and abroad; and two aerolites had fallen, one in America, and one near the town of Constantine, in Algeria. A magnificent meteor was seen in the United States in December last, from which one of these aerolites was projected. An equally splendid aerolite passed over Cape Colony on the 16th of March last, with loud explosions; but no aerolites were known to have fallen from it in its flight. Among the ten brilliant fire-balls might be enumerated those seen in England, of which one, at least—that which burst over the Channel on September 24th—was one of the most unusual brightness. The other conspicuous meteors noticed since the previous report took place on November 8th and March 17th, as well as on April 6th. This last meteor was exceedingly brilliant over Cork and Waterford, in Ireland. A remarkable success in the work of calculating the real paths and velocities had been made known in Germany, where Dr. Von Niessel had shewn that two large detonating meteors which burst with loud explosions over Bavaria and Bohemia April 9th, 1874, and April 10th, 1876, were not only connected together in date and in the place of their appearance, but also astronomically in the system to which they belonged, as they were both found in their origins, or the direction of their course, to have had a common radiant point. The committee had been engaged in the continued examination and comparison of star showers, and in this enquiry an immense labour had been performed for the past twelve months by Mr. W. F. Denning, of Bristol. Besides observing himself, and reducing to their radiant points nearly 1,000 meteors during that period, he had searched through in catalogues fully 12,000 tracks, and of these he had projected one or two thousand on maps, and had concluded from them nearly 150 radiant points. There had been no marked star showers for one or two years; but some examples of frequency on certain nights had occurred in America on the night of 18th-19th October last, and on the 23rd August and 13th September in England. The star shower of December 12th was seen to advantage at several stations, and was a most conspicuous display. The August showers of 1876 and of the present month had both been below the average of brightness for that shower, but several series of observations of them were made. The past year had added fully thirty or forty radiant points to those recorded before. In continuation, the report gave descriptions of several brilliant meteors observed in 1876 and their rates of velocity, which varied from  $19\frac{1}{2}$  to 40 miles per second. On the subject of meteoric irons, statistics were given of the fallen meteors found in the Mexican district, which amounted in total weight to more than fifteen tons. The report concluded with an account of a meteoric fall on April 26th last year in Shropshire. After a heavy explosion like that of artillery, which was audible for many miles, a meteorite was found in a field near the town of

Wellington. When discovered it was still warm, and weighed  $7\frac{3}{4}$  lbs. It had been exhibited at a bazaar at Wolverhampton, and since then the Duke of Cleveland had presented it to the British Museum. The fall of only eight aerolites had been recorded in England, of which the last occurred in 1844. Mr. Glaisher referred in terms of eulogy to the labours of Professor Herschel in connection with this branch of the section's work.

#### AN INDIAN METEOR.

One of the Secretaries read a paper by Major G. N. MONEY, giving "An account of a Meteor which passed over Bhawnpore, in India, in October, 1873." While staying at the capital of the independent state of Bhawnpore, on the Sutlej, he was aroused from sleep early one morning by a tremendous sound resembling the passage of several express trains, while the room was brightly illuminated, and this sound was followed by violent explosions which shook the building. He at first supposed an earthquake had occurred. After breakfast he heard that a shower of stones had fallen eighteen miles off to the north-east, and later in the day some pieces were brought in. The largest was an irregular mass, 3 feet long by 1 foot thick, still hot, and blackened outside as by the action of fire, of a dark gray colour inside, and very heavy. The natives said there were many more—one as large as a bullock cart. A second shower fell about thirty miles beyond the first. There could be no deception, as there were no other stones within a hundred miles of Bawnpore, the soil being purely alluvial or sandy. The meteor, it appeared, was seen by a European who was superintending the erection of a palace for the Nawab. He described it as a huge ball of fire, as big as twenty moons, which passed with a roaring sound directly over his head in a north-easterly direction. It lit up the whole sky, the light being perfectly dazzling, and left behind it a flaming track of red, green, and yellow. Before passing out of sight two explosions in quick succession took place, at each of which a shower of sparks seemed to fall, but no alteration was apparent in the size or shape of the meteor itself. No attempt was made by the Government to collect information about this remarkable meteor. To give some idea of its magnitude it was stated that it was seen and heard at points quite 400 miles from Bhawnpore.

Professor HERSCHEL said it was remarkable how many large explosions of meteors had been observed in recent years. In that reported from the United States last December, the meteors followed each other like a flock of geese, but only one of them fell to the earth.

#### ATMOSPHERIC OZONE.

Mr. G. M. DIXON wrote, with respect to the work of the committee appointed to examine into the reliability of certain methods recently proposed for the quantitative estimation of atmospheric ozone, that the necessary arrangements for the experiments had not yet been completed, and the PRESIDENT announced that whilst Mr. Dixon's proposed method for the measurement of ozone had not yet been tried, it was intended to satisfactorily test it before any great length of time.

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#### THE FRENCH ASSOCIATION AT HAVRE.

With a view to mutual advantage the meeting of the French Association was held this year at Havre, and the time fixed to follow immediately upon the Plymouth meeting. Our report upon the French meeting will be given next month.



# OZONE TEST PAPERS.

*To the Editor of the Meteorological Magazine.*

SIR,—A correspondent in your number for August, who signs himself “J. D. P.,” relieves himself by making a great lamentation over the evils of Schönbein’s “Ozone Papers,” as if he had made a great discovery, and as if he was ignorant of the fact that the whole subject has been dealt with exhaustively years ago. The large majority of your readers must know that the fallacies inherent in the old system of observing Ozone, and the improved modes which can alone be considered reliable have been fully described. Any method to be reliable must rest, as I have many times pointed out, on the acceptance of the following principle :—

To estimate Ozone apart from all other bodies in the air, it is necessary to pass a *known* quantity of air over a test paper, alone influenced by Ozone at a *known* and *unvarying* velocity.

Let meteorologists do that in any way they like. I shall be very glad to learn that any improvements have been devised of the means for attaining this object, which have been described in my work, entitled, “Ozone and Antozone: When, Where, Why, How is Ozone observed in the Atmosphere.”—I remain, Sir, yours faithfully,

CORNELIUS B. FOX, M.D., F.M.S.

*Chelmsford, August 25th, 1877.*

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*To the Editor of the Meteorological Magazine.*

SIR,—Referring to the letter of your correspondent, “J. D. P.,” in this month’s *Meteorological Magazine*, we beg to forward you a sample box of our ozone test papers, which have now been in use in all parts of the world for some years past, and have always given every satisfaction.

We remain, your obedient servants,

NEGRETTI & ZAMBRA.

*Holborn Viaduct, E.C., August 27th, 1877.*

[We have sent “J. D. P.” some of these papers, and shall be happy to send other specimens where desired.—Ed.]

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# AUGUST METEORS.

*To the Editor of the Meteorological Magazine.*

SIR,—I am surprised to see letters in the papers noticing the scarcity of Perseides this year. Surely it must be owing to the condition of the sky. I and many others out here thought them more numerous than usual. Taking advantage of a cloudless evening, with an intensely clear sky, I was one of a party of 14 who on the evening of the 10th ascended 7000 feet above the sea to see the sun set, and to remain on the mountain all night to see him rise. From 10 p.m. till daylight the shower of Perseides was incessant. Very many were of large size, but the greater part were small, and some of them most minute. The largest number was seen between the hours of 11 p.m.

and 2 a.m. There were also a great many shooting stars in all parts of the sky : indeed, from the 7th to the 12th inclusive, they were abundant every night.

On the 25th a magnificent meteor made its appearance at 7.55 p.m. At a point about 2 degrees N. of Jupiter, and travelled slowly and almost horizontally eastward. Its colour was yellow, and the nucleus pear-shaped, and about four times the size of Venus when at greatest brilliancy. It left a trail of considerable length, and threw out during its course smaller meteors on either side of the nucleus. These travelled a short distance, also leaving short trails. The meteor disappeared behind the point of a mountain 7 miles off and 8000 feet high, due E.S.E. from this. It seemed at the moment of disappearance to be breaking up, and I think must finally have disappeared near Mars, which rose over the same mountain a short time afterwards, Saturn having already risen when I lost sight of the meteor.

It was witnessed by a great many English who are here, and caused much consternation amongst the villagers. Sunday, the 19th, was intensely hot and an uncomfortably dry day here. I give you the readings of the dry and wet bulbs.

	Dry.		Wet.		Difference.		Weather.
3 a.m. ....	57.0	.....	52.6	.....	4.4	.....	<i>b</i>
9 „ ...	70.0	.....	62.5	.....	7.5	.....	<i>b</i>
1 p.m. ....	89.0	.....	65.0	.....	24.0	.....	<i>b</i>
3 „ .....	89.0	.....	66.0	.. ...	23.0	.....	<i>b</i>
5 „ .....	81.0	.....	63.0	.....	18.0	.....	<i>b</i>
6 „ .....	79.0	.....	64.0	.....	15.0	.....	<i>c.</i>
9 „ .....	67.0	.....	64.0	... ..	3.0	.....	<i>t.s.</i>

Truly yours,

MICHAEL FOSTER WARD, F.R.A.S., F.M.S.

*Rossinière, 25th August.*

### WHIRLWIND NEAR GUILDFORD, SURREY.

The following paragraph appeared in the *Times* of Saturday, August 11th :—

A correspondent writes under date, Guildford, August 10th :—“To-day a whirlwind of violent character passed over the villages of Cranleigh and Alfold, Surrey. The morning had been rainy, with slight thunder and lightning. In the afternoon a heavy storm set in. This was followed by a whirlwind. On the farm of Mr. George Bruford oak trees of 10 ft. in circumference were snapped asunder, while others were torn up by the roots. Wheat sheaves were whirled in the air and carried in some instances distances of two miles. Cocks of hay were raised in the air and scattered in all directions. In the village of Alfold roofs were torn from various houses. Two labourers working in a harvest field at Alfold were lifted bodily from their legs and landed in an adjoining meadow. Faggot stacks were whirled in the air and scattered over the country.”

As this account is somewhat exaggerated, it may be interesting to state what actually occurred, as far as we were able to ascertain by visiting the spot on the following Monday (August 13th.)

On Wednesday, August 8th, the morning was hot and close, with a westerly wind; about 3 o'clock the wind backed to south, and blew strongly, and it commenced to rain heavily; about five minutes past 3 the whirlwind occurred; it seems to have commenced in the neighbourhood of Alfold, and travelled in a N.N.E. direction; the effects of it are traceable almost as far as Cranleigh, a distance of about three miles; in that village, however, no rain fell, nor was there any very strong wind felt during the afternoon.

The country over which the whirlwind passed was mostly arable, with large trees in the hedges, but the track was not at all clearly defined, there being in many cases nearly a quarter of a mile without any signs of its passage; yet it appears that the track, although not perfectly straight, never varied much from a direct line.

The first trace we could find was in a belt of trees which crossed the track nearly at right angles, N.E. of Alfold Park Farm; the damage extended about 20 or 30 yards, which would apparently mark the width of the track; the side branches were not taken off, but those meeting the wind were broken back into the trees, and some of them six or eight inches in diameter were carried right through the trees to a distance of several yards. The whirlwind then passed over some low undergrowth and another belt of trees about a couple of hundred yards off, without leaving any trace, but it then swooped down again on two trees in the next field, the distance between these was about 50 yards, yet both were considerably damaged. On the further side of the field a small oak about a foot in diameter was snapped off about four feet from the ground (this probably required more force than any of the other damage); it then passed over a field of standing corn, and crossed the road a little to the north-west of Alfold Crossways, taking some of the ridge tiles off one of the cottages adjoining the road, and disarranged a wood-stack, &c. From this point it seems to have lifted over the rising ground on the other side of the road, and appeared again at Brockhurst Lees, where it slightly damaged several trees, upset a haystack, and took some of the tiling off a stable roof; a man working in the stable at the time said he heard a rushing, roaring noise, and, looking out, saw the trees and hay blowing about, and thought he had better stay where he was. Between here and Holdhurst Farm the trees were considerably damaged, one having the upper part, where the stem was eight or ten inches in diameter, broken right off, and the corn stacked in the fields ready for carrying was whisked about in a most disorderly manner. The track at this part was, however, very undecided, and seems to have curved about considerably, leaving the direct course and passing round west of the hill by Holdhurst Farm. In the middle of a field adjoining the road, between Holdhurst Farm and Knowle Farm, a small oak, about a foot in diameter, was torn up by the roots; this was the last damage of any importance, the whirlwind crossing the road by Knowle Farm, where it lies slightly in a valley, and damaging a few trees in

some thickly wooded grounds on the other side. After this it seems to have entirely disappeared, no trace of it reaching Cranleigh.

As regards the two men mentioned in the *Times* we could only hear of one who was working in a field and was almost taken off his feet but we were unable to find him to hear his account.

### GREENWICH EXTREME TEMPERATURES.

The extreme Shade Temperatures of the month of August at the Royal Observatory, Greenwich, during the past 36 years.

Year.	Maximum.		Minimum.		Year.	Maximum.		Minimum.	
	deg.	date.	deg.	date.		deg.	date.	deg.	date.
1841	79·6	27	45·5	12	1859	91·3	25	46·5	31
1842	90·5	10	47·5	30	1860	70·8	4, 16	45·5	7
1843	82·8	19	47·2	10	1861	89·3	12	46·2	31
1844	75·4	20	42·5	27	1862	79·9	1	44·7	24
1845	77·8	31	43·2	1	1863	84·9	9	46·0	21
1846	92·0	1	47·5	13	1864	88·6	5	38·1	27
1847	87·7	1	42·3	3	1865	78·0	27	43·2	3
1848	74·7	3	43·1	9	1866	78·5	26	45·0	19
1849	82·5	9	42·4	5	1867	89·0	14	40·9	3
1850	81·0	5	40·0	22	1868	90·5	5	47·8	26
1851	82·0	12	42·2	31	1869	89·0	28	42·1	31
1852	81·5	1	49·9	4	1870	81·0	1, 6	41·0	31
1853	77·5	19	45·8	18	1871	89·2	13	46·1	28
1854	85·2	28	43·0	18	1872	81·7	17	45·0	28
1855	79·0	28	47·3	14, 30	1873	87·3	8	47·9	29
1856	89·8	2	45·0	23	1874	81·2	19	44·0	24
1857	88·0	3	48·8	28	1875	85·4	16	43·6	2
1858	86·9	12	43·8	29	1876	93·8	14	41·1	26

Extremes in 1877, Max. : 83°·3 on 20th ; Min. : 40°·5 on 24th.

	Year.	Max.	Date.	Min.	Date.	Year.
Means of 36 years	...	84·0	13	44·5	19	...
Highest .....	1876	93·8	14	49·9	4	1852
Lowest .....	1860	70·8	4, 16	38·1	27	1864
Range .....	...	23·0	...	11·8	...	...

Addiscombe, 7th Sept., 1877.

EDWD. MAWLEY.

## AUGUST, 1877.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "1 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.		In shade	On grass		
				Dpth	Date.			Deg.	Date.			Deg.	Date.
I.	Camden Town .....	2.23	— .41	.55	25	17	82.9	20	42.4	24	0	...	
II.	Maidstone (Hunton Court)....	2.58	+ .38	.92	25	11	...	...	...	...	0	1	
III.	Selborne (The Wakes).....	3.86	+ .68	.76	7	15	74.6	20	34.0	24	0	...	
IV.	Hitchen .....	3.02	+ .67	.49	26	19	75.0	20	41.0	31	0	...	
V.	Banbury .....	4.30	+ 2.17	.75	27	22	77.0	20	37.0	24	0	...	
VI.	Bury St. Edmunds (Culford).	2.76	+ .32	.32	16	19	79.0	20	37.0	23	0	...	
VII.	Norwich (Sprowston).....	...	...	...	...	...	...	...	...	...	...	...	
VIII.	Bridport .....	3.20	+ .61	.93	7	10	...	...	...	...	...	...	
IX.	Barnstaple .....	5.09	+ .90	1.10	7	18	...	...	...	...	...	...	
X.	Bodmin .....	6.38	+ 2.52	.94	26	22	73.0	14	45.0	24	0	0	
XI.	Cirencester .....	6.31	+ 3.47	1.20	14	20	...	...	...	...	...	...	
XII.	Shifnal (Haughton Hall) ...	5.00	+ 2.13	.78	7	23	78.0	7	41.0	24	0	...	
XIII.	Tenbury (Orleton) .....	4.89	+ 2.01	.67	14	24	79.0	20	38.8	24	0	0	
XIV.	Leicester (Belmont Villas) ..	2.57	...	...	...	...	...	...	...	...	...	...	
XV.	Boston .....	2.92	+ .63	.61	27	18	81.0	20	41.0	24	0	...	
XVI.	Grimsby (Killingholme) .....	4.12	...	1.55	25	18	74.0	7	43.0	24	0	...	
XVII.	Mansfield .....	4.73	...	1.00	25	23	78.9	6	42.0	24	0	...	
XVIII.	Manchester .....	...	...	...	...	...	...	...	...	...	...	...	
XIX.	York .....	4.46	+ 1.75	.85	25	16	75.0	7	42.0	24	0	...	
XX.	Skipton (Arnccliffe) .....	7.11	+ 1.17	.85	22	28	75.0	17	34.0	23	0	...	
XXI.	North Shields .....	6.32	+ 3.47	1.58	18	27	68.0	1, 8	42.0	24	0	...	
XXII.	Borrowdale (Seathwaite).....	11.79	— 2.29	2.00	18	20	...	...	...	...	...	...	
XXIII.	Cardiff (Crockherbtown).....	5.70	...	1.14	27	21	80.0	20	41.1	2	0	...	
XXIV.	Haverfordwest .....	6.07	+ 1.19	1.11	21	16	77.2	5	39.0	23	0	...	
XXV.	Aberdovey .....	6.98	...	1.65	20	19	81.0	5, 15	47.0	23	0	...	
XXVI.	Llandudno .....	5.77	+ 1.95	1.03	21	22	74.4	6	47.0	23	0	...	
XXVII.	Dumfries (Crichton Asylum)	6.95	+ 3.30	1.19	19	22	73.0	17	37.4	24	0	...	
XXVIII.	Hawick (Silverbut Hall).....	7.56	...	1.54	18	29	...	...	...	...	...	...	
XXIX.	Kilmarnock (Annanhill).....	3.76	...	...	...	...	...	...	...	...	...	...	
XXX.	Castle Toward .....	6.79	+ .49	1.32	21	20	74.0	16	37.0	23	0	...	
XXXI.	Mull (Quinish) .....	4.15	...	.63	8	20	...	...	...	...	...	...	
XXXII.	St. Andrews (Cambo Ho.) ...	6.85	...	...	...	...	...	...	...	...	...	...	
XXXIII.	Grandtully .....	5.03	...	1.30	20	16	...	...	...	...	...	...	
XXXIV.	Braemar .....	6.29	+ 2.45	2.20	20	22	67.8	7	30.2	25	1	4	
XXXV.	Aberdeen .....	6.55	...	1.59	20	25	66.2	16	39.7	25	0	0	
XXXVI.	Gairloch .....	4.80	...	.95	30	22	...	...	...	...	...	...	
XXXVII.	Portree .....	4.91	— 2.54	.83	29	25	...	...	...	...	...	...	
XXXVIII.	Inverness (Culloden) .....	5.06	+ 1.81	1.14	21	20	71.1	7	39.7	25	0	1	
XXXIX.	Helmsdale .....	5.16	...	.88	20	25	...	...	...	...	...	...	
XL.	Sandwick .....	2.50	— 1.21	.46	7	21	64.0	13	40.4	25	0	...	
XLI.	Caherciveen Darrynane Abbey	...	...	...	...	...	...	...	...	...	...	...	
XLII.	Cork .....	6.08	...	1.25	17	16	...	...	...	...	...	...	
XLIII.	Waterford .....	6.66	+ 2.71	1.52	18	18	78.0	1	39.0	24	0	...	
XLIV.	Killaloe .....	5.77	+ .84	1.58	16	21	85.0	4	35.0	23	0	...	
XLV.	Portlargo .....	3.48	— 1.02	.44	9	27	...	...	...	...	...	...	
XLVI.	Monkstown, Dublin .....	4.78	+ 1.57	1.54	15	22	76.0	20	41.5	23	0	...	
XLVII.	Galway .....	5.22	...	.63	21	23	75.0	13	41.0	23	0	...	
XLVIII.	Ballyshannon .....	4.46	...	.72	18	24	...	...	...	...	...	...	
XLIX.	Waringstown .....	...	...	...	...	...	...	...	...	...	...	...	
L.	Edenfel (Omagh) .....	5.74	...	1.28	15	25	69.0	13*	37.0	22	0	...	

\* And 16.

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

## METEOROLOGICAL NOTES ON AUGUST.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; 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.

SELBORNE.—T and L at 7 p.m. on 7th; L at 7 p.m. on 21st; TS at 10 a.m. and 7 p.m. on 25th. Min.  $34^{\circ}$  at 4 ft. on 24th. The coldest August I have ever recorded, the only August in which frost on grass has occurred excepting on 31st in 1869 and 1870. Bad harvest weather, some wheat growing in sheaf; potatoes much diseased; hops promising both in quality and quantity.

HITCHIN.—The coldest and wettest August for many years.

BANBURY.—Very little corn carried; wheat much injured by sprouting; potatoes much diseased. Flood in the Cherwell valley on 28th.

CULFORD.—High wind on 9th; T on 15th, 21st, and 31st, and a very severe TS on 16th; a wet and rather cold month, max. temp. being  $79^{\circ}$ , and the min.  $37^{\circ}$ , the mean  $60^{\circ}\cdot 8$ . The rainfall slightly above the average; prevailing winds S. and W. The most severe TS which has for many years been experienced in this district occurred on the afternoon of the 16th. A large tree in the neighbourhood of Bury was struck, set on fire, and burnt to ashes; several buildings were also struck and slightly injured, but happily no serious damage has been sustained.

BODMIN.—Mean temp. of the month  $63^{\circ}\cdot 1$ ; R 3 in. above the average of the last 28 years.

SHIFNAL.—Another cold, rainy, ungenial month. Remarkably low temp. throughout, exceeding  $70^{\circ}$  on four days only, and  $55^{\circ}$  on seven nights only. Distant T all the 15th, and severe with heavy R at 6.30 p.m.; again heavy storm on the 25th at 6.45 p.m. The grain crops suffering sadly, and troublesome harvest. No wasps as yet, and scarcely a butterfly (not even white) in the garden; no mushrooms; swifts all gone by the 12th.

ORLETON.—Another cloudy month, with frequent heavy falls of R, and a damp atmosphere. The rainfall nearly double the average; very unfavourable for ripening the corn from the absence of sunlight. Mean temp. nearly  $3^{\circ}$  below the average. Frequent TSS on 15th and 16th; T heard on 14th, 15th, 16th and 25th. Violent winds on 21st and 28th.

LEICESTER.—Very unsettled weather, especially during the latter part of the month, but very much less rain has fallen here than in some parts of the country.

GRIMSBY, KILLINGHOLME.—T at 11.45 a.m., and at 3.40 p.m. on 8th.; T 4.20 p.m. on 15th, and L at night; TS on evening of 16th; TS at 10.30 a.m. on 21st. The wettest August I have ever registered; potato disease rife at the close; corn ripe on the 20th, but, owing to the rain, corn cutting was not general till the 23rd. Root crops will be heavy, but fruit scarce.

MANSFIELD.—25th,  $\cdot 76$  of R fell from 8 to 9 p.m. on 24th. A damp, close month, with heavy rains at intervals; all produce late; strawberries not over at the end of the month; temp. nearly as high as that of July; July temp. at 9 a.m.  $61^{\circ}\cdot 7$ , August at same time  $60^{\circ}\cdot 1$ ; temp. at 9 p.m., July  $56^{\circ}\cdot 4$ , August  $56^{\circ}\cdot 8$ ; mean temp., July  $59^{\circ}\cdot 7$ , August  $59^{\circ}\cdot 5$ .

ARNcliffe.—Unusually wet, dark, and sunless. No 48 hours in the month without R.

NORTH SHIELDS.—8th, TS; 21st, TS; 24th, lunar halo. (Total fall in July should have been 2.45 not 2.43).

SEATHWAITE.—8th, T; 12th, T; 16th, T and L.

## WALES.

HAVERFORDWEST.—The weather was very fine, and warmer than the preceding month up to the 15th, after which it became very unsettled; heavy storms of R, accompanied by T and L from 19th to 22nd, and again from the 25th to the end of the month, rendering harvest work very difficult. I find from the 1st of September, 1876, to the end of August, 1877,  $69\cdot 21$  in. of R has fallen. The present summer throughout has been cold and unseasonable.

**ABERDOVEY.**—20th, heavy R with T, total fall 1·65 in. ; 25th, heavy R, with high wind. A very wet month, most unfavourable both for hay and corn harvest.

**LLANDUDNO.**—20th, began to cut oats ; 21st, TS at 5 a.m., R to 10.30 a.m., then fine but windy ; 24th, barley cut. Like July—variable, wet, and on the whole cold month. Rainfall more than double the average, and the mean temp.  $1\frac{1}{2}^{\circ}$  below it. Corn and crops all late, and much damaged by the wind and disease appearing among potatoes.

#### SCOTLAND.

**DUMFRIES.**—August has been unprecedentedly wet, rainfall (6·95) nearly double the average ; mean temp.  $55^{\circ}\cdot9$ , and bar. pressure low ; TSS were registered three times ; prevailing winds, easterly.

**SILVERBUT HALL, HAWICK.**—7th, TS ; 15th, hay got in. The rainfall here has been more than double that of any August during the last 11 years. The oldest inhabitant never saw such a wet hay season. The potatoes are going rapidly to ruin from disease ; the corn crops are quite green yet, and much of it laid flat by the wind and R. Much of the hay is still out and sadly spoiled ; the pods of garden peas do not fill, gooseberries are almost useless through bursting. The sun has scarcely been seen during the season.

**CASTLE TOWARD.**—With the exception of a few days the month of August has been one of the most dismal of the year. We have had severe rainfalls for the short time they lasted. As a rule in former seasons the harvest was pretty general by this time, but this season the crops look as green as they did two months ago. It is difficult to say when cutting will become general. The crops will be three or four weeks late this year. Much of the standing corn has been laid by the wind and rain, and is not likely to rise again. Potatoes are also giving way and will not be a profitable crop.

**QUINISH, ISLE OF MULL.**—The extraordinary fall of R, 18th to 21st, reported elsewhere in Scotland, was not felt here to the same extent, the four days only showing a fall of 1·07 in. during that period. The month has been singularly broken, with R from all points of the compass, rapid changes of weather and temp.

**BRAEMAR.**—A most unseasonable and unusually wet month ; at the close hard frost and hills covered with fresh snow. Potato crop rendered almost useless, being so late.

**ABERDEEN.**—Bar. pressure and mean daily temp. below the average ; night temp. and R above it. Winds from N., N.E., E., and S.E. above the average. A month of exceptionally dull, wet, and cold weather. Crops greatly damaged by the R of the 20th and 21st.

**PORTREE.**—A very cold month ; scarcely any sunshine during the month, which has kept the crops much behind in ripening ; very little of the hay crop yet secured. Heavy H showers at 10.30 a.m. on 23rd. [A strong frost on the 1st of September ; ice half an inch thick at 9 a.m. on the 2nd. Potatoes blackened.]

**SANDWICK.**—27th, three peals of T with L between 4 and 8 p.m. While there have been great floods in most parts of Britain, we have reason to be thankful there has been nothing of the kind here. Indeed, islands are little liable to such floods, even when the rainfall has been excessive, as the R soon reaches the sea ; but the rainfall here this month has been much less than the average of the last five or six years, and more than half an inch below the average of the previous 36 years. At Balfour Castle the fall was only 1·50 in., while here it was 2·50 in. There has, however, been much cold N. wind, and the crops are two or three weeks later than usual.

#### IRELAND.

**WATERFORD.**—Wind very variable, principally N, rarely W., rather high wind on 31st ; average temp. of month,  $60^{\circ}\cdot5$ .

**KILLALOE.**—The heavy rainfall of this month has seriously retarded farm work, and the saving of the hay and corn crops claims the utmost diligence of the farmer. TS on 15th, followed on 16th by a much more severe and protracted one, with heavy R ; 1·35 in. fell between 9.30 p.m. and midnight. This heavy fall sent down floods from the mountain ravines, carrying away bridges, hay, and

some live stock, and doing much damage to adjoining lowland. Very little corn cut about here, but nearly all ripe and waiting for fine weather. Potato disease increasing, and the haulm now quite destroyed. Eclipse of 23rd could only be seen here from 9.45 to 10.30 p.m.

**MONKSTOWN.**—The wettest August for many years. The fall on the 15th was extremely partial, under .10 in. having been registered at Bray, and about .60 in. in Dublin, while here it was 1.54 in., it fell with T and L; temp. low for the time of the year.

**BALLYSHANNON.**—Another very wet month, grain crops much injured, and still unhoused. It is much feared that the potato crop in this country will be a failure; the haulms are completely cut away, and more than half the potatoes are rotten.

**OMAGH.**—Persistent E, high wind, and low temperatures have again been the characteristics of the last of our summer months, which has passed without summer having reached us. As a result the hay harvest is as yet uncompleted, flax unpulled, corn green, and the general prospects of the farmer are very dark indeed.

### SUPPLEMENTARY TABLE OF RAINFALL IN AUG., 1877.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see Met. Mag., Vol. XI, p. 28., but the list is under revision.]

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol .....	1.88	XI.	Llanfrechfa .....	6.19
„	Hailsham .....	2.69	„	Castle Malgwyn .....	6.12
„	St. Lawrence, I. of W....	2.47	„	Heyope .....	...
„	Andover.....	3.07	„	Carno .....	6.69
„	Strathfield Turgiss .....	2.06	„	Rhug, Corwen .....	5.41
III.	Addington Manor.....	4.14	„	Port Madoc .....	4.96
„	Oxford .....	3.09	XII.	Melrose .....	6.76
„	Northampton .....	3.71	XIV.	Cessnock, Glasgow .....	7.33
„	Cambridge.....	3.82	XV.	Gruinart .....	4.44
IV.	Sheering .....	3.82	XVII.	Keith .....	5.94
„	Ipswich .....	2.70	XVIII.	Dalwhinnie .....	...
„	Diss .....	2.80	„	Auchnasheen .....	...
„	Swaffham .....	4.05	„	Springfield, Tain .....	4.67
V.	Compton Bassett .....	3.62	XX.	Skibbereen .....	...
„	Dartmoor .....	12.27	„	Glenville, Fermoy .....	7.51
„	Teignmouth .....	4.09	„	Tralee.....	4.49
„	Langtree, Torrington ..	6.30	„	Newcastle W., Limerick ..	5.08
„	Cosgarne, St. Austell ...	7.75	„	Kilrush .....	8.91*
„	Taunton.....	3.30	XXI.	Kilkenny .....	5.30
VI.	Bristol .....	5.39	„	Kilsallaghan .....	5.21
„	Sansaw .....	5.09	„	Twyford, Athlone .....	5.41
„	Cheadle .....	5.50	XXII.	Ballinasloe.....	4.82
VII.	Coston, Melton Mowbray ..	3.05	„	Kylemore .....	7.64
„	Bucknall .....	2.94	„	Carrick on Shannon.....	2.97
VIII.	Walton, Liverpool .....	4.76	XXIII.	Rockcorry .....	2.76
„	Broughton-in-Furness ..	7.97	„	Warrenpoint .....	8.73
IX.	Stanley, Wakefield .....	3.96	„	Carnlough, Larne.....	...
X.	Gainford .....	4.99	„	Bushmills .....	3.65
„	Shap .....	6.18	„	Buncrana .....	6.23

\* Tremendous rain on 16th, 4.46 in.; the observer reports it as occurring between 1.45 and 4.0 p.m., and adds that there has been nothing like it for fifty years.