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THE NEW ENGLAND METEOROLOGICAL SOCIETY.

[THE demands on our space are such that we are frequently obliged to omit notice of good work. Hence alone it has been that we have not oftener reported the proceedings of the above-named Society. But its First Annual Exhibition has been such a success, and so many instruments not previously described in these pages were shown, that we reprint, with slight alterations, the account as given in the *Meteorological Journal*, omitting such parts as refer to instruments, &c., well known in this country. We have been favoured by Mr. Lawrence Rotch with a photograph of the exhibition, which is at once very acceptable and very tantalizing. One regrets the impossibility of having been there.—ED.]

THE EXHIBITION OF THE NEW ENGLAND METEOROLOGICAL SOCIETY.

SEVERAL months since, the New England Meteorological Society, following the annual custom of the Royal Meteorological Society of London, decided to hold a loan exhibition in Boston in connection with its fourteenth regular meeting. Accordingly a circular was issued, which was printed in the November issue of this Journal, requesting contributions of meteorological apparatus, photographs, charts and specimens. The exhibition was opened in the Physical Laboratory of the Massachusetts Institute of Technology, January 15, and was continued seven days.

The Blue Hill Meteorological Observatory displayed instruments used in its regular and experimental work. In the latter class were the registering aneroid barometer, wind-vane and thermometers, used by Professor Upton and Mr. Rotch during the late total solar eclipse in California, besides the registering actinometer put in action probably for the first time during a total solar eclipse. This instrument, which was made by Richard Brothers of Paris, has a bright and a black globe, in each of which is a thermometer, whose indications are registered on a drum, an ingenious device correcting the influence of changes of temperature upon the transmitting medium of the solar thermometers.

There were the Watkin and Hottinger aneroid barometers, the first being intended for mountain use without thereby sacrificing an open scale. To accomplish this, the needle travels three times around the dial in its passage from 23 inches to 31 inches, and an index, actuated from the axis of the needle, shows which of the concentric circles should be read.

In the Hottinger instrument the expansion and contraction of the vacuum box is measured by a micrometer and vernier to the thousandth of an inch. This instrument is the property of the U.S. Signal office. There was also the *thermomètre á marteau* made by Baudin. This is an alcohol minimum, but can be placed vertical, unlike any other, and its index is not subject to displacement by wind. A spring attached to the index keeps it in a fixed position, but is not strong enough to prevent the film of alcohol from drawing the index downward wnen the temperature falls. The thermometer is set by turning it bulb upward when an enamel rod in the bulb descends the bore, and, acting as a hammer, forces the index to the end of the column.

A simple portable anemometer is the one made by Hicks for the London Meteorological Office. In it the Robinson cups are geared to a dial, but can be disconnected by inverting a sand-glass. To determine the velocity of the wind, the cups are allowed to acquire the normal velocity before the sand-glass is turned over and the registration commenced. At the expiration of two minutes, when the sand has ceased to flow, the glass is reversed and the wind's velocity, in miles per hour, read off at leisure from the dial. This instrument costs in London £5, and if it could be manufactured cheaply in this country it would be a valuable adjunct to the equipment of the stations of our State Weather Services.

Among the new apparatus was the recording rain and snow gauge devised by S. P. Fergusson, and described in the November Journal.

A seismograph made from designs of Professor Ewing, of Dundee, Scotland, was also shown, in which a heavy disk is suspended by three wires, and below it is a vertical weighted rod in unstable equilibrium. A rod fulcrumed above the disk carries a lever with a pen which inscribes upon a smoked glass plate the direction and intensity of the horizontal components of the earthquake shock. The English instrument cost £15, but it is manufactured in San Francisco for £3.

The Harvard College Observatory showed a seismoscope, in which the time of the earthquake is obtained by having a pendulum break an electric current and start or stop a clock. Some tracings obtained by a pendulum seismograph of Prof. Ewing in Tokio, Japan, were loaned by Prof. Rockwood.

A form of the Jordan sunshine-recorder, modified by Prof. Pickering, was shown by the Harvard College Observatory. It is often difficult to find a position with exposure to both morning and afternoon sun. Accordingly the apparatus is made in two parts—

each being the half of a cylinder with its axis parallel to the earth's axis. These half cylinders contain blue print paper, which is acted upon by the sun shining through holes in the flat sides of the cylinders. These holes are moved down a notch each day, so that one sheet of paper lasts a week. One of the cylinders gives a record of the morning sun, the other of the afternoon sun, and the cylinders may be placed on opposite sides of a house, if necessary.

Another ingenious instrument devised by Prof. Pickering is the pole-star recorder. In this, a telescope and camera are combined so that the trail of the pole-star, as it describes a circle in the heavens, is photographed on the sensitized plate, if the sky be clear. Passing clouds cause the trail to be broken. An alarm clock closes the shutter of the camera at dawn, and can be made also to open it after dark. From these records the amount of cloudiness is obtained at night as it is obtained in the daytime from the sunshine recorder.

The aspiration psychrometer, invented by Dr. Assmann, of Berlin, for obtaining the temperature and humidity of the air under all circumstances, was shown by Mr. Rotch. The wet and dry bulbs of the thermometer are surrounded by a polished metal casing through which air is drawn by bellows at a uniform rate. For use in rain there is a second case to enclose the first.

The Fineman nephoscope, or cloud mirror, was recommended by the International Meteorological Committee. It has a black reflecting surface with means for orienting it and sighting the cloud image by which the direction of motion, and the relative velocity, of clouds can be determined.

Prof. Marvin, of the Chief Signal Office, exhibited a very delicate anemometer with conical cups made of aluminium, used to determine the constants of the anemometers of the Service.

The Signal Service exhibited much new apparatus, including the triple self-register for wind direction and velocity and rainfall. For obtaining the latter the gauge invented by Prof. Marvin is employed. A float in a tube makes an electric contact by means similar to those in the anemometer, for each five-hundredths of an inch of rainfall.

One of the new thermometers for registering electrically at a distance, made by Richard Brothers, of Paris, and just imported by the Signal Service for use at certain of its stations, was shown.

The Signal Service also showed the apparatus used by Sergeant Park Morrill in his study of atmospheric electricity. This included the gas-flame and mechanical collectors invented by Sergeant Morrill, the Trowbridge, Mascart and Mendenhall quadrant electrometers, and the Mascart photographic register. The Physical Department of the Institute of Technology also added to this collection the Clifton and Thomson portable electrometers and the Thomson electrostatic voltmeter.

To the Physical Department of the Institute belonged the thermometer comparators shown. One of these was for making com-

parisons of a mercurial with an air thermometer, the other for comparing the thermometers used by the Society's observers with a standard instrument, all being immersed in water for the purpose.

The Draper Manufacturing Co. sent from New York a beautifully finished recording barometer and some thermometers, and the Standard Thermometer Co., of Peabody, Massachusetts, exhibited a tele-thermometer, metallic thermometers and thermostats.

Among the curiosities of the exhibition were a bottle and a saucer fused together by lightning, and a piece of window glass which had been ground translucent by the sand-bearing winds of Cape Cod.

Professor Abbe sent his printed weather bulletins, first issued in September, 1869, at the Cincinnati Observatory. Soon after commencing, telegraphic reports were received from fifteen stations, and on October 6, predictions for Cincinnati and vicinity were begun.

Owing to the generous response to the circular requesting the loan of articles, particularly by the U.S. Signal Service, the exhibition was a success, and was so well attended by visitors that it was continued three days longer than was originally intended. Now that the feasibility of such an exhibition has been demonstrated, it is to be hoped that others will follow, as there can be no doubt of their effect in stimulating the study of meteorology.

THE THUNDERSTORMS OF MAY AND JUNE.

THE Royal Meteorological Society will have its hands full. It has been inviting information respecting thunderstorms, and has come upon a year in which they seem to be exceptionally numerous and destructive. It would be waste of labour, of time, and of money, for us to deal fully with the mass of material with which we have been favoured; it is far better to give here only some brief notes, and to pass on the information *in extenso* to the Thunderstorm Committee of the Royal Meteorological Society, who are the proper persons to deal with it.

MAY 23RD.

Hampstead.—Sharp TS in afternoon, with H as large as marbles; ·68 in. of R, and one or two accidents by L.—B. WOODD SMITH.

Hadham House, Upper Clapton.—Very large H; 12 weighed exactly 12 grammes (185 grains), but they were not dense, and therefore out of the hundreds of square feet of glass in my garden not one pane was broken. Between 3.22 and 4.2 p.m. excessive R, during which 40 minutes nearly 2 inches fell, as there was only moderate R from 4.2 to 5.30, at which time 2·07 inches was measured.—J. PARNELL.

Warwick Road, Upper Clapton.—R during TS quite phenomenal = 2·65 in.—W. HAYWARD.

Enfield.—Violent TS, 1.15 p.m. to 4 p.m.; H 1 inch long; R 2·10 in.; tree struck close to house.—T. PAULIN.

Tottenham.—TS 3.15 to 5.15 p.m., with large H, and 1·45 in. of R in the 2 hours.—J. E. WORTH.

TSS and damage by L and by local floods in *Northampton*, *Rutland*, and *Lincoln*. *Barrowden* Church spire seriously damaged.

Walton, Wakefield.—TS between 1 and 2 p.m., yielding 1·15 in., the most in so short a time that I have registered during 14 years. —E. SIMPSON.

Doncaster.—TS in afternoon; house struck by L.

Normanton.—TS in afternoon; offices of the Local Board struck by L, also a house in *Altofts*.

N. Riding of Yorkshire.—Severe TSS, and much damage both by L and by H.

MAY 24TH.

Worcestershire.—Severe H storm. At *Martley* some H stones were 4 in. long; poultry and even one sheep killed. More than 24 hours afterwards H was measured $\frac{3}{4}$ in. in diameter. One farmer alone had 20 ducks and nearly as many chickens killed by the H. Cattle also killed by L and trees struck. As regards the H, it is said not to have been equalled since 1852, prior to which there were great H storms in 1830 and 1811.

Uppingham.—Sharp TS with H. Between 5.0 and 5.23 p.m., ·51 in. fell, and of that probably ·34 in. fell in the first nine minutes.—G. H. MULLINS.

Derbyshire.—TS and much damage done; one man killed.

Queensbury, Bradford.—Woman killed by L.

MAY 29TH.

Buildings struck at *Liverpool*, *Preston*, and other places in *Lancashire*. Hail up to $1\frac{3}{4}$ in. in diameter; local floods, and a whirlwind near *Frodsham, Cheshire*.

JUNE 2ND.

Meltham, Yorks.—Three TSS, one 7 to $7\frac{1}{2}$ a.m., another 8.50 to 9.20 a.m., and the third 2.35 to 5 p.m. During the last some exceptionally large H fell. One stone was measured $1\frac{3}{8}$ by $1\frac{1}{8}$ by $\frac{1}{2}$; 29 stones, when melted, gave 0·30 in. in an 8 in. rain gauge glass, so that each stone must have contained nearly half a cubic inch of water. Most of them had opaque centres and a coating of clear ice, but one was, and probably more were, composed of four layers, the kernel being opaque, then a layer of clear ice, then more opaque ice, and finally a clear ice coating. There was only one fall of these large ones, it lasted less than a minute, and they fell at an average distance of about three yards one from another.—C. L. BROOK.

Allendale, Northumberland.—Two houses struck by L.

Pawston, Cornhill-on-Tweed.—Very severe TS about noon; H $1\frac{1}{2}$ in. in diameter, and ·62 in. of R in 20 minutes (time carefully noted).—B. P. SELBY.

Berwick-on-Tweed.—11 a.m. to 1 p.m. heavy TS with much H in many towns and villages. Much conservatory glass broken; at *Allanbank*, *Allanton*, over 1,000 panes were broken. The H was

frequently more than one inch long, perhaps $1\frac{1}{4} \times 1 \times \frac{1}{2}$, but it is often reported as 5 inches in circumference, which would give $1\frac{1}{2}$ in. in diameter.

JUNE 6TH.

Langton Herring, Dorset.—The most terrific TS for 28 years, began in evening of 6th and lasted till 6.30 a.m. of 7th. R = 1·89 in. A house damaged and a cow killed.—C. H. GOSSET.

Bishop's Cannings, Devizes.—Heavy TS, and six cottages burnt down.—C. W. HONY.

Camden Square.—Grand TS between 9 and 11 p.m. ; L finer than I have seen since 1858. There were several separate centres of storm, mostly working from S. to N. No H of importance fell here, and the R was not exceptional, total 0·52 in.—G. J. SYMONS.

Northwood Road, Highgate.—The most glorious TS I ever saw. Heavy R, total 1·03 in., but the special feature was the beauty and frequency of the L. About 9.20 p.m. I began to count the displays, and, from a rough calculation, made the number up to that time 100 ; from then to 11.10 p.m. I counted 1,144 distinct displays, giving a total of 1,244 in two hours. Some of the flashes lasted perceptibly longer than others—in fact, one lasted while I counted up to ten.—H. SOWERBY WALLIS.

JUNE 7TH.

Rusper, Horsham.—Sharp TS between 1 and 2.30 p.m. In $1\frac{1}{4}$ hours 2·20 in. of R fell at Rusper Rectory, and in 30 minutes at Rusper House 0·86 in. was measured.—A. F. PARBURY.

Tunbridge Wells.—Sharp TS at 4 p.m., with H, which varied much in size in different parts of the town, but in Garden-road was as large as pigeon's eggs, and one stone was measured in Pembury-road *the next day* $1\frac{1}{4}$ inches in diameter.—T. COBB, JUN.

Ipswich.—Violent TS about 3 a.m., with much H. Many thousand squares of glass broken ; indeed, the loss is put at 100,000 panes. No very large sizes are mentioned, but as the H broke 21 oz., and even 26 oz. glass, it must have been large and hard. At the Corn Exchange two lights, made with glass $\frac{1}{4}$ inch thick, were smashed. The storm continued in parts of Essex and Suffolk until after noon.

EARTHQUAKE SHOCK, MAY 30TH, 1889.

A RATHER sharp shock of earthquake was felt on both sides of the English Channel about 8.20 p.m. on May 30th.

STRUCTURAL DAMAGE.

This is, as far as we have heard, confined to the following :—

Cherbourg.—The windows of several houses broken, a bell turret on the Cathedral thrown down, and the cornice of the doorway of the Church of the Holy Trinity thrown to the ground.

Portsmouth.—Part of the plaster of the ceiling of St. Michael's Church fell among the congregation, and one young woman had her arm injured.

LIMITS WITHIN WHICH IT WAS FELT.

From France we have no reports south of latitude 48°, and it was felt most in Normandy and in Brittany. Paris seems to have been near the south-eastern limit. It was sharp in the Channel Isles, and caused suspended objects, lamps, lustres, cranes, &c., to oscillate along the English coast from the Land's End to Eastbourne, but it did not extend far inland. But for an isolated record from Henwick, near Worcester, we should have fixed the northern limit at which it was perceived as being slightly to the north of a line drawn through Bristol and London. We have eight or nine reports from London, but the letters with which we close this article sufficiently indicate its character towards its N.E. limits.

The reported times are not so discordant as usual, though they range from 8.14 to 8.30. The Channel Islands returns are mostly 8.14 or 8.15, and this is vexatious, because they are nearly equally wrong, whether this is supposed to be local or Greenwich time. If local time, then the shock is reported from there at about 8.24, which is probably four minutes later than the real time, and 8.15 is probably five minutes too early.*

Our impression is that the centre of the shock was nearly under Cherbourg, and at 8.20 p.m., and that the vibration travelled outwards at about 90 miles a minute, reaching the watering places on the south coast about 8.21, London 8.21½, and Worcester between 8.22 and 8.23.

This satisfies most of the coast reports, agrees precisely with Mr. Sowerby Wallis's time for Highgate, and agrees within a fraction of a minute with the most distant observation, viz., that at Worcester.

SIR,—I think it may interest you to know that two slight lateral shocks of earthquake were distinctly felt here last evening at about half-past eight. They were observed by two members of my family, one upstairs and one down. They were also observed next door. We read in the newspapers to-day that there were shocks of earthquake at Guernsey last evening at about 8.15.—Yours truly,

LEWIN HILL.

22, *Parliament Hill Road, Hampstead, May* 31*st*, 1889.

SIR,—On the evening of Thursday last (May 30th), sitting reading in a room here, facing S.E., I felt a movement which I at first attributed to a distant train, but as it had more of an undulatory character and was not followed by the passage of a train, it occurred to me that it might be an earthquake and I carefully noted the time, 8 hours 21 min. 30 sec. p.m.

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* We are sorry to discredit these Channel Islands reports, but when we state that the records for Jersey and for Sark, which are within a few miles, differ by *eleven minutes* (= 1,000 miles travel of shock), it will be apparent why we have had to leave them out. When will people learn to keep their clocks right, and to *be precise* in noting *the time of phenomena*?

I intended to check my watch by a standard clock the next day, but, under the pressure of other matters, overlooked it. I have, however, fairly good evidence that the above is within a minute of true Greenwich time.

During the rest of the evening I remained in the same chair, and amused myself by noticing the very different character of the shaking caused by passing trains.

The sensation appeared to be that of an undulation travelling from S.E. to N.W.—Yours obediently,

H. SOWERBY WALLIS.

25, *Northwood Road, Highgate, June 4th*, 1889.

SIR,—You may be expecting information about the earthquake shock on the South Coast, perceived on the evening of May 30th. The following is the mem. I have made :—

May 30th.—About 8.15 to 8.20 p.m., a distinct earth-tremor from west to east was felt here, lasting for a few seconds. Not perceived by anyone in my own house, but distinctly opposite ; also by invalids in bed and by children, who woke up frightened and startled, saying their bed was being lifted up off the ground beneath them ; by others that the walls seemed to sway to and fro, west to east, and that crockery jingled. I have not been able to find that any clocks stopped. The weather was fine ; sky quite clear ; wind S.E. ; barometer 29·92, had been falling *very slightly* from 1 p.m. to 8 p.m., rising a fraction from 8 p.m. to 8.30 p.m., then steady till midnight ; the max. temp. in the shade for the day was 58°·6.— Yours very truly,

W. J. HARRIS.

Church House, Heene, Worthing, June 1st, 1889.

A COLD PERIOD.

M. LANCASTER has a paper on this subject in the last number (No. 6, 1889) of *Ciel et Terre*, entitled "The Temperature in Europe, 1885 to 1888," to which we desire to call attention.

It may be remembered that in our March number we gave a table in which we compared the values for Greenwich, Paris, Brussels, and Toronto in each month of the last four years, with averages extending over long periods, and finally summed up by showing that the greatest deficiency of temperature was at Toronto in 1885, viz., —2°·6, followed by Paris in 1887, —2°·1, and Paris, 1888, —1°·9, and that, on the mean of the four years for the four stations, the deficiency was about 0°·8 per annum, and we therefore said :—

"We do not think that it is necessary to pursue the subject further, as all these values are within the limits of variation of mean annual temperature."

M. Lancaster evidently does not think so, as he has devoted seven more pages of *Ciel et Terre* to it. We do not say that he was unwise in so doing, but we should like to show on what we relied in writing

the previous three lines. We found that at Greenwich the difference from the mean was, for the respective years :—

1886.	1886.	1887.	1888.	Mean for the four years.
0°·0	+0°·1	−0°·8	−1°·0	−0°·4

Then we turned to the useful and interesting diagram in Drew's *Practical Meteorology*, on which is plotted the mean temperature of every year from 1771 to 1853 at Greenwich, and we found such cases as the following* :—

* We have taken the Greenwich mean temp. at 49°·0; this is probably rather too low, but we prefer to take a value which cannot be impugned.—See *Quar. Jour., Roy. Met. Soc.*, vol. xiv., p. 34.

1784.	1785.	1786.	1787.	Mean.
−4°·0	−2°·6	−3°·2	−0°·9	−2°·7
1796.	1797.	1798.	1799.	
−1°·2	−1°·8	−0°·4	−3°·3	−1°·7
1813.	1814.	1815.	1816.	
−1°·8	3°·2	−0°·1	−2°·6	−1°·9
1837.	1838.	1839.	1840.	
−1°·7	−2°·6	−1°·3	−1°·2	−1°·7

Every one of these groups is more than four times as remarkable as the 1885—88 period, and that is why we thought that we had devoted sufficient time and attention to the matter.

On the other hand, meteorology is in many branches so much of a puzzle that no one can presume to dictate the path which will lead to the discovery of the key to the whole, and therefore we welcome the efforts which M. Lancaster has made, and we hope will continue, to track the conditions which have produced this recent cold period.

We can, of course, reproduce here only fragments from M. Lancaster's article, but we will endeavour to select such as will bring out the salient points :—

Nearest Similar Periods at Brussels.

Nov. 1841 to Oct. 1845,	48 months,	30 months	below the mean;	aver. defect	1°·3
Nov. 1846 to Oct. 1850,	48 ,,	28 ,,	,, ,,	,,	0°·7
Feb. 1853 to Jan. 1857,	48 ,,	27 ,,	,, ,,	,,	1°·1
Nov. 1884 to Oct. 1888,	48 ,,	32 ,,	,, ,,	,,	1°·4

Defects in 1885—88 *in various parts of Europe.*

	Lat.	Lon.	Months below mean.	Average defect. deg.
St. Martin de Hinx, Bayonne, France	43° 45′ ...	1° 16′ W.	37 ...	2·2
Perpignan, France	42 43 ...	2 53 E.	36 ...	1·8
Tarm, West Denmark	55 53 ...	8 31 E.	38 ...	1·8
Löningen, Oldenbourg	52 44 ...	7 44 E.	33 ...	1·6
Göttingen	51 32 ...	9 56 E.	33 ..	1·4
Madrid, Spain	40 25 ...	3 43 W.	34 ...	1·4
Brussels, Belgium	50 52 ...	4 21 E.	32 ...	1·4
Utrecht, Holland	52 5 ...	5 7 E.	32 ...	1·4
Shields, Northumberland, England	55 0 ...	1 27 W.	33 ..	1·3
Paris, France	48 50 ...	2 20 E.	29 ...	1·0
Stornoway, Lewis, Scotland	58 11 ...	6 22 W.	34 ...	0·9
Lisbon, Portugal	38 41 ...	9 10 W.	33 ...	0·7
Greenwich, England	51 28 ...	0 0	28 ...	0·4

Relative Intensity in Eastern and in Western Europe.

M. Lancaster proceeds to divide 22 records into two groups,

11 easterly and 11 westerly stations, and he finds that, at the westerly stations, the deficit was 1°·3, and at the easterly only half as much, or 0°·7; he states further that, at Genoa and Milan, there has been an excess, but he does not state the amount.

It seems to us that the above table shows such irregularities as prove that M. Lancaster has a heavy task before him, and this is corroborated by the consideration that, besides the most fruitful source of error—changed instruments, changed positions, and in many cases changed modes of computing the mean temperature—there is the fact of no two observatories quoting averages extending over precisely the same group of years. Probably the best plan would be to collect a very large number of reports, so that errors may be diminished by neutralization. Certainly cases of excess should be reported as carefully as those of defect, because it is quite likely that in them may be found the explanation of the persistent cold.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday, May 15th, at the Institution of Civil Engineers, 25, Great George-street, Westminster. Dr. W. Marcet, F.R.S., President, in the chair.

Mr. T. H. Hall was elected a Fellow of the Society.

The following papers were read:—

1. "Account of some experiments made to investigate the connection between the Pressure and Velocity of the Wind," by Mr. W. H. Dines, B.A., F.R.Met.Soc. These experiments were made for the purpose of determining the relation between the velocity of the wind and the pressure it exerts upon obstacles of various kinds exposed to it. The pressure plates were placed at the end of the long arm of a whirling machine, which was rotated by steam power. The author gives the results of experiments with about 25 pressure plates, all differing in shape or size. The pressure upon a plane area of fairly compact form is about $1\frac{1}{2}$ lbs. per square foot for a velocity of 21 miles per hour; or, in other words, a pressure of 1 lb. per square foot is caused by a wind of a little more than 17 miles per hour.* The pressure upon the same area is increased by increasing the perimeter. The pressure upon a $\frac{1}{4}$ ft. plate is proportionally less than that upon a plate either half or double its size. The pressure upon any surface is but slightly altered by a cone or rim, projecting at the back, a cone seeming to cause a slight increase, but a rim having apparently no effect.

2. "On an improved method of preparing Ozone papers, and other

* This is the most satisfactory statement that we have seen respecting anemometry for a long time. As far back as 1860 Col. Sir H. James, R.E., F.R.S., gave 14·1 miles as the equivalent of 1 lb., and in 1861 Mr. Harvey Simmonds gave it as 14·8 miles. Hence all authorities seem to agree that when the wind exerts a pressure of 1 lb. on a square foot it is moving with a velocity of between 14 and 17 miles an hour.—ED.

forms of the test, with starch and potassium iodide," by Dr. C. H. Blackley, F.R.Met.Soc. Some years ago the author made some experiments with the ordinary ozone test papers, but found that the papers did not always give the same result when two or more were exposed under precisely the same conditions. He subsequently tried what re-action would take place between unboiled starch and potassium iodide when exposed to the influence of ozone; but the difficulty of getting this spread evenly upon paper by hand, so as to ensure a perfectly even tint after being acted upon by ozone, led him to devise a new method of accomplishing this. Briefly described, it may be said to be a method by which the starch is deposited upon the surface of the paper by precipitation, and for delicacy, and precision in regulating the quantity on any given surface, it leaves very little to be desired.

3. "Notes on the Climate of Akassa, Niger Territory," by Mr. F. Russell, F.R.G.S. This paper gives the results of observations made from February, 1887, to October, 1888, at Akassa, which is the seaport and principal depôt of the Royal Niger Company, and is situated at the mouth of the River Nun in the Niger Delta.

4. "Wind Storm at Sydney, New South Wales, on January 29th, 1889," by Mr. H. C. Russell, F.R.S.

WATERSPOUT IN DORSET, JUNE 7TH.

A correspondent of *The Times* at Yeovil, telegraphing on the 9th inst., says:—

"A great disaster befell a rural district of Dorsetshire on Friday evening last. During the afternoon thunder and lightning had been incessant, but very little rain had fallen. About six o'clock in the evening great waves of water from eight to ten feet high rolled down the Batcombe hills upon the little village of Chetnole. What is ordinarily a small brook supplying a millstream became a powerful torrent, and spread alarm among the inhabitants. At Hannaford Mill great damage was done, and stock of all kinds were drowned. At Chetnole Mills the devastation was very great. The torrent brought with it large trees which it had uprooted. Everything that stood in its path was swept away. Men who were working at the mill engines had only just time to rush out of the building before the water reached the top of the first floor. Several school children were rescued by Major Digby. The damage to property is estimated at several thousand pounds. The villages of Cerne and Mintern also suffered greatly, and miles of road were washed away. Several cottagers had all their furniture carried away. The cause of the remarkable occurrence was for some time unknown. It has now been ascertained that a waterspout burst on Batcombe-hill. An eye-witness described it as a solid stream of water of about the thickness of a man's body. It tore up the ground to a considerable depth, and forced a channel for its escape down the hillside."

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOVEMBER, 1888.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0–10
England, London	59·9	16	34·6	28	51·0	43·3	43·3	87	78·9	28·2	4·38	20	7·9
Malta	77·6	2	49·1	23	69·0	57·2	53·0	75	126·3	43·8	·74	7	4·4
Cape of Good Hope.	81·8	13	48 0	4	67 8	53·5	...	...	...	...	1·42	8	...
Mauritius	84·6	23	67·0	16	82·1	70·1	65·1	71	138·1	59·1	1·25	15	6·1
Calcutta	86·7	1	58·3	19	80·9	65·5	64·4	68	148·5	49·4	3·13	2	4·2
Bombay	95·6	2	70·0	21	88·2	75·4	70·9	70	144·6	58·1	1·16	7	3·3
Ceylon, Colombo	88·7	...	71·8	...	86·8	73·8	72·5	81	154·0	68·2	14·19	21	6·2
Melbourne	102·0	23	38·1	1	74·1	51·8	49·4	64	145·9	28·4	·62	6	4·8
Adelaide	105·8	23	46·4	11	83·4	59·4	49·3	45	156·8	39·4	·66	8	3·5
Wellington	66·5	19	39·0	2, 25	60·8	46·4	44·9	72	138·0	33·0	7·10	20	4·4
Auckland	71·0	17*a*	45 0	10, 25	63·3	50·3	47·4	70	135·0	36·0	3 63	22	6·0
Jamaica, Kingston	94·3	13	63·7	27	91·3	70·2	70·7	74	...	...	·07	...	...
Barbados	...	...	...	...	..	...	...	...	...	...	...	...	...
Toronto	62·0	1	14·1	23	43·9	31·3	33·6	80	...	9·0	3·10	19	7·6
New Brunswick, Fredericton	60·7	2	— 0·5	23	39·7	23·6	30·7	80	...	...	6·47	15	6·0
Manitoba, Winnipeg	46·7	12	—4·0	19	32·5	16·6	21·2	85	...	...	·50	11	6·1
British Columbia, Victoria	55·0	1	25·0	16	47·5	37·9	...	...	...	...	2·69	16	...

a And 18.

REMARKS, NOVEMBER, 1888.

MALTA.—Mean temp. 61°·8; mean hourly velocity of wind 10·7 miles. Sea temp. fell from 69°·0 to 64°·8. TS on 19th; L on 22nd and 23rd; H on 23rd. R 3.39 in. below average. J. SCOLES.

Mauritius.—Mean temp. of air 1°·6 above, of dew point 1°·5 above, and R ·56 in. below their respective averages. Mean hourly velocity of wind 10·5 miles, or 0·8 below average; extremes 28·2 on 11th and 2·2 on 1st and 9th. Prevailing direction, E. by N. T on 7th, L on 18th, and T and L on 19th. Fine solar halos on 10th and 16th. Floods in the southern part of the island on 19th. C. MELDRUM, F.R.S.

COLOMBO.—TSS on 17 days and L on one other day. J. C. H. CLARK.

Melbourne.—Mean temp. of air 2°·5 and of dew point 0°·9 above the average; humidity 3, mean amount of cloud 1, and R 1·92 in. below the average. Prevailing winds S. and S.W.; stormy on 13 days. Distant T on 2nd and 27th; T and L on the 9th; L on the 2nd and 3rd. R. L. J. ELLERY, F.R.S.

Adelaide.—The hottest November on record. Mean temp. nearly 5° above the average of 32 years. R two-thirds of the average. Drought general over the whole colony. C. TODD, F.R.S.

Wellington.—Unpleasant and showery weather almost throughout. Strong S.E. wind on the 9th, 10th, and 11th; cold and stormy from 13th to 16th. Prevailing wind N.W. T on 20th; H on 1st and 23rd. Mean temp. 2°·9 below and R 2·93 in. above average. R. B. GORE.

Auckland.—Unusually cold, stormy, and showery. Mean temp. 4° below the average, and the lowest recorded for November. R ·75 in. above the average; pressure considerably below it. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, MAY, 1889.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	4·03	XI.	Castle Malgwyn	2·60
,,	Margate, Birchington...	2·02	,,	Rhayader, Nantgwillt..	4·10
,,	Littlehampton	2·28	,,	Carno, Tybrith	3·91
,,	Hailsham	1·43	,,	Corwen, Rhug	3·89
,,	Ryde, Thornbrough	2·03	,,	Port Madoc	2·27
,,	Alton, Ashdell.....	3·51	,,	I. of Man, Douglas	2·67
III.	Oxford, Magdalen Col...	2·91	XII.	Stoneykirk, Ardwell Ho.	3·37
,,	Banbury, Bloxham	3·81	,,	New Galloway, Glenlee	4·37
,,	Northampton	3·34	,,	Melrose, Abbey Gate...	2·08
,,	Cambridge, Beech Ho...	3·92	XIII.	N. Esk Res. [Penicuick]	2·45
,,	Wisbech, Bank House..	3·65	XIV.	Ballantrae, Glendrishaig	3·42
IV.	Southend	2·40	,,	Glasgow, Queen's Park.	3·19
,,	Harlow, Sheering	3·89	XV.	Islay, Gruinart School..	2·12
,,	Rendlesham Hall	2·47	XVI.	Dollar.....	2·60
,,	Diss	2·87	,,	St. Andrews, Pilmour Cot	1·59
,,	Swaffham	2·72	,,	Balquhidder, Stronvar..	5·02
V.	Salisbury, Alderbury...	2·03	,,	Dunkeld, Inver Braan..	3·20
,,	Warminster	...	,,	Dalnaspidal H.R.S. ...	3·49
,,	Bishop's Cannings	1·98	XVII.	Keith H.R.S.	·32
,,	Ashburton, Holne Vic....	3·10	,,	Forres H.R.S.	·45
,,	Hatherleigh, Winsford.	3·07	XVIII.	Strome Ferry H.R.S....	2·19
,,	Lynmouth, Glenthorne.	3·53	,,	Fearn, Lower Pitkerrie.	·66
,,	Probus, Lamellyn	3·88	,,	Loch Shiel, Glenaladale	3·74
,,	Launceston, S. Petherwin	3·31	,,	N. Uist. Loch Maddy ...	2·40
,,	Wincanton, Stowell Rec.	2·32	,,	Invergarry	1·39
,,	Taunton, Lydeard Ho...	...	,,	Loch Ness, Drumnadrochit	1·20
,,	Wells, Westbury.....	4·07	XIX.	Lairg H.R.S.	·40
VI.	Bristol, Clifton	2·69	,,	Forsinard H.R.S.	...
,,	Ross	3·81	,,	Watten H.R.S.	·47
,,	Wem, Clive Vicarage ...	3·15	XX.	Dunmanway, Coolkelure	4·79
,,	Cheadle, The Heath Ho.	3·64	,,	Fermoy, Gas Works ...	3·42
,,	Worcester, Diglis Lock	2·93	,,	Tipperary, Henry Street	3·75
,,	Coventry, Coundon	3·42	,,	Limerick, Kilcornan ...	1·63
VII.	Ketton Hall [Stamford]	6·14	,,	Miltown Malbay.....	4·80
,,	Grantham, Stainby	4·71	XXI.	Gorey, Courtown House	3·07
,,	Horncastle, Bucknall ...	3·77	,,	Navan, Balrath	2·07
,,	Mansfield, St. John's St.	3·77	,,	Mullingar, Belvedere...	2·69
VIII.	Neston, Hinderton	2·31	,,	Athlone, Twyford	3·43
,,	Knutsford, Heathside ...	2·66	,,	Longford, Currygrane...	3·84
,,	Lancaster, South Road.	4·10	XXII.	Galway, Queen's Coll...	4·41
,,	Broughton-in-Furness ..	4·34	,,	Clifden, Kylemore	7·91
IX.	Wakefield Prison	3·98	,,	Crossmolina, Enniscoe..	4·97
,,	Ripon, Mickley	2·62	,,	Collooney, Markree Obs.	4·76
,,	Scarborough, West Bank	2·41	,,	Ballinamore, Lawderdale	...
,,	East Layton [Darlington]	2·05	XXIII.	Warrenpoint	3·90
,,	Middleton, Mickleton..	1·48	,,	Seaforde	3·33
X.	Haltwhistle, Unthank..	1·38	,,	Belfast, New Barnsley..	1·89
,,	Shap, Copy Hill	2·85	,,	Bushmills, Dundarave...	2·48
XI.	Llanfrechfa Grange	3·76	,,	Stewartstown	3·50
,,	Llandovery	3·91	,,	Buncrana	4·13

MAY, 1889.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE Max Deg	Date	Min. Deg	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·22	+ 1·30	1·08	26	14	81·2	24	42·7	2	0	0
II.		Maidstone (Hunton Court)...	1·32	— ·70	·37	9	11	...	...	...	...	...	...
,,		Strathfield Turgiss	3·36	+ 1·68	1·70	26	20	79·2	23	40·3	2	0	0
III.		Hitchin	4·33	+ 2·34	1·37	11	19	77·0	24	40·0	2	0	...
,,		Winslow (Addington)	3·34	+ 1·11	1·12	26	15	80·0	23*a*	39·0	2	0	0
IV.		Bury St. Edmunds (Culford)	...	...	..	...	...	...	...	...	...	...	...
,,		Norwich (Cossey)	3·15	+ 1·34	·90	10	9	79·0	24	...	...	...	...
V.		Weymouth(LangtonHerring)	1·24	...	·39	8	11	73·0	24	43·0	1, 11	0	...
,,		Barnstaple.....	3·43	+ 1·33	·70	16	17	70·0	23	35·0	11	0	...
,,		Bodmin	4·35	+ 1·51	·85	8	19	68·0	22	40·0	2	0	0
VI.		Stroud (Upfield)	3·11	+ ·81	·74	24	14	79·0	22	40·0	11	0	...
,,		ChurchStretton(Woolstaston)	3·24	+ ·85	·54	11	16	75·0	22	36·5	2	0	1
,,		Tenbury (Orleton)	3·19	+ ·76	·74	24	17	78·2	22	35·0	2	0	0
VII.		Leicester (Barkby)	3·69	+ 1·81	·90	26	18	84·0	24	35·0	1	0	0
,,		Boston	3·16	+ 1·39	·82	10	14	85·0	22	37·0	3	0	...
,,		Hesley Hall [Tickhill].....	3·71	...	·76	10	16	80·0	22	38·0	3	0	...
VIII.		Manchester (Ardwick).....	2·31	+ ·08	·65	11	13	75·0	22	42·0	1	0	...
IX.		Wetherby (Ribston Hall) ...	2·95	+ 1·13	1·14	11	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	2·95	— ·17	·72	10	13	81·0	22	45·0	10	0	...
,,		Hull (People's Park)	2·95	+ 1·07	·64	10	13	...	...	...	...	...	...
X.		North Shields	1·48	— ·37	·40	27	16	75·0	22	39·2	15	0	0
,,		Borrowdale (Seathwaite).....	5·79	— 1·19	1·32	30	18	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·86	+ ·26	·70	31	17	...	...	...	...	...	...
,,		Haverfordwest	3·39	+ ·70	·83	17	15	70·1	21	36·0	14	0	2
,,		Plinlimmon (Cwmsymlog) ...	3·48	...	·65	29	12	...	...	...	...	...	...
,,		Llandudno.....	2·53	+ ·91	·47	16	15	68·2	21	40·5	2	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·33	+ ·80	·68	10	15	76·4	21	39·0	27	0	...
,,		Jedburgh (Sunnyside).....	1·55	— ·24	·34	27	10	77·0	21	39·0	30	0	...
XIV.		Old Cumnock	2·56	+ ·16	·45	10	15	81·5	21	34·0	26	0	...
XV.		Lochgilphead (Kilmory).....	3·04	+ ·28	·65	29	18	...	...	..	...	..	...
,,		Oban (Craigvarren)	2·81	...	·75	7	18	71·5	6	41·9	25	0	...
,,		Mull (Quinish).....	2·52	...	·40	7	18	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·10	+ ·81	·80	15	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	1·45	— ·49	·40	28	12	75·3	22	40·6	3	0	...
XVII.		Braemar	1·30	— 1·12	·48	14	9	71·0	6*b*	36·4	13	0	7
,,		Aberdeen (Cranford)	1·18	...	·26	31	10	71·0	22*c*	39·0	26	0	..
XVIII		Lochbroom	1·10	...	·24	7	10	...	...	...	...	...	...
,,		Culloden	·72	— 1·06	...	...	...	73·0	7*d*	41·0	26	0	0
XIX.		Dunrobin	·83	...	·32	29	6	68·8	21	40·0	1	0	...
,,		S. Ronaldsay (Roeberry).....	·66	— ·84	·22	1	7	69·0	22	41·0	18	0	...
XX.	IRELAND.	Cork (Blackrock)	4·72	+ 2·56	·80	2	16	70·0	27	40·0	12*f*	0	...
,,		Dromore Castle	4·80	...	·62	2	21	69·0	27	34·0	6	0	...
,,		Waterford (Brook Lodge) ...	3·32	...	·62	5	16	68·0	27	38·0	25*g*	0	...
,,		O'Briensbridge (Ross)	2·32	...	·29	29	18	72·0	22*e*	42·0	1	0	...
XXI.		Carlow (Browne's Hill)	2·58	+ ·46	·64	5	16	...	...	...	..	...	...
,,		Dublin (FitzWilliam Square)	2·13	+ ·41	·51	5	17	72·5	21	40·8	11	0	1
XXII.		Ballinasloe	3·59	+ 1·18	·41	29	22	68·0	20	32·0	7	1	...
XXIII		Waringstown	2·35	+ ·24	·39	12	15	79·0	20	39·0	1*h*	0	0
,,		Londonderry (Creggan Res.).	...	...	...	...	...	...	...	...	...	...	...
,,		Omagh (Edenfel)	3·62	+ 1·27	·94	5	18	70·0	21	35·0	24	0	...

a And 24. *b* And 21. *c* And 23. *d* And 21, 22. *e* And 23. *f* And 14. *g* And 27. *h* And 26, 30.
+ Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON MAY, 1889.

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

ENGLAND.

STRATHFIELD TURGISS.—The weather was very unsettled at the beginning of the month, but was relieved by a few spring-like days of sunshine. R storms were frequent, and the temp. varied considerably; from 21st to 25th very hot, the close of the month cool and showery. TSS on 9th and 17th. Wild strawberry in flower and oak in leaf on 11th.

HITCHIN.—The hottest May in 40 years' record, and the wettest but two.

WINSLOW, ADDINGTON.—A very favourable month, vegetation making rapid progress. No frost, not even on grass; the temp. rose to 80 twice, having reached that point only once before in May since 1871. There were two falls of R exceeding an inch, which caused very large floods, that on the 26th doing an immense deal of damage to the hay crop.

WEYMOUTH, LANGTON HERRING.—The R for the five months of this year is only 62 per cent. of the average, and less than in the corresponding period of any of the 13 previous years. Mean temp. at 9 a.m. for May 57°·3, the highest in May during 18 years, and 3°·7 above the average. The max. in shade on 24th has only once been exceeded in May in 17 years. Solar halos on 4th, 8th, and 12th. Slight TSS on 6th and 11th.

BODMIN.—On the whole a cold May, but a very bright enjoyable month.

UPFIELD, STROUD.—TSS on 5th and 24th; L on 6th, 17th, 23rd and 30th. On 24th, ·26 in. of R fell within 15 minutes, and the TS was preceded by a great gust of wind, which blew down two or three trees.

WOOLSTASTON.—A warm genial month, very favourable for the hay crop, which promises to be heavy. Violent storms of T and L on 5th, 7th and 9th. Mean temp. 54°·8.

ORLETON.—The temp. and the weather were variable, with frequent TSS, followed by many cloudy and gloomy days. From 19th to 25th the weather was unusually bright and hot. Mean temp. nearly 2° above the average of 28 years. Fluctuations of pressure slight. TSS on 4 days and T on 7 days. The storm of the 24th was accompanied by large and destructive H. Cherry trees in full bloom about the 3rd, and apple trees about the 20th.

HULL.—With the exception of the 10th and 11th, the weather up to the 23rd was generally fine; from that date to the end of the month it rained more or less every day, often with T, and a heavy fall of H on 30th.

NORTH SHIELDS.—TSS on 4 days and T on 4 other days.

WALES.

HAVERFORDWEST.—The most genial May for many years, with an entire absence of frost in air, though white frosts occurred on the 10th and 14th. The oak was in leaf on the 15th and the ash had almost bare branches at the end of the month; no such disparity can be remembered. The R, though scarcely the average, was so distributed over the month as to secure, with the genial warmth, abundance of grass. Barley sowing late. Every description of tree in leaf exceptionally early, and if nothing unforeseen occurs there is every promise of a beautiful summer.

SCOTLAND.

CARGEN.—A remarkably fine and warm month, the warmest recorded during 30 years. Mean temp. 54°·5, or 3°·6 above the average. Sunshine 243 hours, or 23 hours above the average; the last week of the month was considerably cooler than the first 23 days. Vegetation made unusual progress, and corn, hay, and pastures never looked better at this season. All flowering trees and shrubs in bloom three weeks earlier than usual. E. and S.E. winds prevailed for 17 days.

JEDBURGH.—The weather during the month was remarkably fine; the temp. was high and the result was a rush of vegetation that has not been equalled in May for a long series of years. All crops alike in garden and field look well and are far advanced.

CRAIGVARREN, OBAN.—A decidedly warm month, very free from E. winds and of equable temperature. R moderate; growth making great progress, grass and foliage in particular both forward and abundant in quantity. Slight T on the 7th; sheet L on the 14th.

QUINISH, MULL.—A warm dripping month, most favourable to growth. This spring season is the earliest and best that has been known for the last 25 years, being distinctly better than the remarkable one of 1878.

BRAEMAR.—The finest May on record, foliage and vegetation looking remarkably well and three weeks in advance of former seasons. Mean temp. 51°·7.

ABERDEEN.—The finest May experienced here for a great number of years.

LOCHBROOM.—The month in every respect could not be excelled so far as outdoor work is concerned, but followers of Walton complain. TS on 7th.

CULLODEN, INVERNESS.—The month was finer in all respects than any May for more than 20 years. E. winds and damaging frosts were entirely absent. R very small, but there were heavy dews at night and the growth of grass was constant, and the same can be said of corn crops and vegetation generally.

S. RONALDSAY, ROEBERRY.—The driest May since 1876.

IRELAND.

CORK.—On the whole a very propitious month, although the wettest May during 24 years, except 1869 and 1878. Mean temp. about the average. Total R to the end of May 15·93 in., which is 4·44 in. less than the average of 24 years.

WATERFORD.—R 1·01 in. above the average.

ROSS, O'BRIENSBRIDGE.—Excellent vegetation during the month. Frequently very warm and bright, with heavy dews and sufficient R. Mean temp. above the average of 10 years.

DUBLIN.—A very favourable month, singularly free from parching E. winds, with a high mean temp. and genial R. Atmosphere generally quiet and no gales. Solar halos on 16th and 20th. Foggy on 9 days, high winds on 5 days; H on 31st. The mean min. on grass was 42°·4, compared with 37°·5 in May, 1888, and 37°·9 in May, 1887.

BALLINASLOE.—Wet, windy, and cold. TSS on 14th and 23rd.

FLOODS IN AUSTRALIA.

EXTRACT from a letter written by R. Humphrey Marten, M.B. Camb., of Adelaide, South Australia:—

"April 22nd, 1889.

"I wrote you on Jannary 1st, saying our fearful drought had broken up, and it continues to break, and people say they can now believe in the history of Noah and the ark.

"It began to rain on Sunday last, and continued in one steady downpour till Wednesday evening. In some places as much as 8½ inches fell in 24 hours, and the average throughout the colonies was over an inch in 24 hours. The floods came down our usually dry rivers in tremendous torrents, sweeping everything before them—man, beast, produce, bridges, all swept away—and even in our city the floods reached a dangerous height. We have a dam to uphold a lake in the river which flows through the city, and although the dam stood, it was rendered useless by the floods boring out a new course for the river. The oldest settlers never remember such rains, and everyone is jubilant about the glorious seasons it will lead to. All the dams and tanks throughout the country are full, and lakes have appeared inland where no such things were ever dreamt of."