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VOLUME THE THIRTEENTH.

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SYMONS'S

MONTHLY

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FEBRUARY, 1878.

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INTRODUCTORY.

WE have dropped the habit of penning an introductory paragraph to each volume ; but a 13th volume seems like the commencement of a new series, and therefore we think that a few words will not be inappropriate.

In the first place, we regret to report ourselves as the only independent meteorological periodical in the world. Our highly esteemed contemporary, the *Zeitschrift*, is, as its full title states, the organ of the Austrian Meteorological Society ; then, also, the *Quarterly Journals* of the Meteorological Society and of the Scottish Meteorological Society are the organs of the respective societies ; the *Annuaire* of the Société Météorologique de France, and all the other publications are subsidized in some form or other by Government or Corporate bodies. We, therefore, claim the support of all who think that we strive, without fear or favour, for the advancement of our science, and who believe that an independent field open to all parties is desirable.

Secondly, we wish these pages to be of as much use, and as much interest, to our readers as is possible. That our efforts are successful we are convinced by a steadily increasing list of subscribers, but we wish to advance still faster. We are not going to forsake the old paths, but we hope to improve and to widen them. We have revised the stations inserted in the monthly tables, and in our next we hope to give the latitude and longitude of them all, and also a map of the British Isles showing their position. The reviewing of books is rearranged, as is fully explained in the article entitled "*Books Received and Short Notices thereof.*" The only other changes rest with our readers, and not with ourselves. We think that there has been a falling off in the number of letters sent to us for publication ; if so, it is a pity, because fresh and numerous writers give variety and crispness to any periodical.

Finally, we think that it may be useful to devote a page or so to answering questions put by our readers, and by observers in general. We are not so unreasonable as to assume infallibility, or that we can answer all the questions that may be put; but we will do what we can, and when we leave a question unanswered we hope that some one else will do it for us—nay, rather, for the benefit of all our readers.

THE EARTHQUAKE OF JANUARY 28TH.

EARTHQUAKES are so rare in England that even a slight one is of interest. Moreover, the country is so populous, and well informed people are so scattered over it, that if we could only ensure that clocks were made to keep true time, we might learn much, as to the nature of the crust of the globe in this locality, from the slight shocks which do occur. It is rather singular that our last number contained the following paragraph:—

“On March 17th, 1871, a rather sharp shock of earthquake was felt across England, and in North Wales and Dumfriesshire; unfortunately the reports as to time are not sufficiently accurate to afford positive proof, but they seem to indicate that the shock emanated from North Lancashire. We hope that when the next one occurs every observer will try to report the *true time*.”

Within a fortnight of the publication of that paragraph, even London itself has been shaken, and yet only three of our regular correspondents seem to have noticed it. We give their reports first, and then a summary of the notices in the newspapers, and finally an analysis of them all, and a statement of what they seem to teach.

Mr. Whipple, Director of Kew Observatory, was at the top of that building, felt the shock, and at first considered that it was an earthquake, but second thoughts leading him to attribute it to the slamming of a door, he did not note the precise time. Subsequently he found that a tremour was registered by the magnetometers at 11.55 a.m., and also a rather large vibration of the Thomson Electrograph, as nearly as possible at the same instant, but he states that such changes are not unusual.

The Rev. C. Malden, of St. Lawrence, Isle of Wight, reports, “Earthquake at 11.57 a.m., very distinct.”

Mr. J. E. Vibert, M.A., &c., St. Aubin's, Jersey, reports, “Remarkable shock of earthquake on 28th inst., at 11.45 a.m.” We believe that this is local time; if so, it corresponds to 11.54 a.m., Greenwich mean time.

Admiral W. A. Bailie Hamilton, writing from Macartney House, The Park, Greenwich, reports the time as 11.50 a.m., or it may have been a few minutes earlier. He writes that the disturbance seemed to come from W. or W.S.W., the west walls of the room in which he was sitting first catching the motion, quickly recoiled (but with less force) from the east wall (that wall, however, being chiefly taken up

by a window). The oscillation of the whole room (apparently) but most palpably of the walls, lasted about a second-and-a-half, and was of sufficient force to disturb and shake very audibly whatever was attached to or touched the west wall of the room; the movement of the wall itself being sufficient to excite a momentary fear as to its stability. The wave or motion does not seem to have acted so powerfully, if at all, on those parts of the house (and it is strongly built) where the end walls face the west; but to have exercised its full force where a considerable length of the wall (as in the case of the room referred to) runs or trends N.W. and S.E. Admiral Hamilton adds that although the Royal Observatory is on the same level as, and not 500 yards from, Macartney House, the shock was not observed there.

LONDON.—"Shortly before 12 o'clock, I, and at least six others on the top floor of Harrington House, Whitehall Gardens, now occupied by the Board of Trade, felt ourselves and chairs distinctly swayed backwards and forwards three times. The peculiar sensation of an earthquake—viz., of being moved not only bodily as distinguished from being shaken, but of being moved as a coherent part of things in general, instead of as a separate body—I had felt before several times, and I had no doubt at the time as to the cause of the agitation on Monday morning."—W. C. MONKHOUSE.

LONDON. 2, *East India Avenue, Leadenhall Street*.—"While engaged writing on Monday last, I most distinctly felt the building oscillate twice, and though I never before experienced the shock of an earthquake, the conclusion that this movement was the result of one forced itself so strongly upon my mind that I took out my watch and noted the time on the paper I was then engaged upon. On reference, I find it was exactly 12½ minutes past 12 p.m."—Y. J. CONNOLLY.

LONDON. 19, *St. Swithin's Lane*.—"I was sitting alone in my office here, quietly reading my *Times*, and most distinctly felt two upheavings of my chair, the sensation being very much like that experienced on board a screw steamship. The time was about 11.55."—J. R. CLIPPERTON.

LONDON. *Upper Phillimore Gardens*.—"My daughter told me on Monday that she had felt, about 12 o'clock, a curious sensation of shaking of the house, as if a heavy waggon had passed by, and thought it might have been caused by an earthquake. As this was said to me at the time, and before any notice about an earthquake on Monday had appeared in the papers, it may be worth notice."—JAMES WESTON.

GREENWICH. *Blackheath Road*.—"I was sitting in our drawing-room, which faces north and north-east, on Monday, when I suddenly felt a very distinct heaving motion of the room, repeated three times, with an oppressive feeling of pressure coming from the north-east window. I immediately said to my sister, who was in the room, 'What's that?' She replied, 'I don't know.' I listened to ascertain any cause for it round the house, and finding none, directly said, 'It is the shock of an earthquake.' My sister said, 'Look at the clock, and note the time.' I did so; it was 11.52 a.m. by our hall clock, which is not far out of the Greenwich ball time. The account in the *Times* of to-day of the shock felt at Jersey appears to confirm my notion of yesterday."—C. C.

BRIGHTON.—"I was sitting writing, when my hand oscillated on the table, and I felt something had happened. I went to the door to ask if the front door (as it blew hard) had been opened, and was met at the door by two friends coming down from the second floor, saying the empty jug in the hand-basin had shook and rattled, and that the sofa had shook and rocked so suddenly as to alarm the occupant, who started up in a fright. The window at the same time rattled to such a degree as to give the impression that furniture was being moved in the room below, in which I was writing. There were two distinct shocks, but the latter was the worse. The time taken—11.55 a.m.—was after the latter."—ANON.

BRIGHTON.—“A little before midday the table at which I was sitting oscillated perceptibly, other articles of furniture vibrated, and the windows rattled as if shaken by a gust of wind.”—M. W.

ST. LEONARD'S.—“At five minutes to 12 o'clock on Monday I felt two distinct shocks of earthquake here.”—ROBERT FROMAN.

OSBORNE.—The earthquake on Monday last was distinctly felt at Osborne by several persons in different rooms at a few minutes before 12 o'clock.

RYDE.—“The earthquake was felt most distinctly here in Ryde about a quarter or 10 minutes before 12 at noon. It made china and flower-pots rattle in my drawing-room, the leaves of ferns and other plants quiver, and the lustres of the candlesticks sway to and fro, while a member of my family, who was sitting there, felt her chair sink under her three times in quick succession so sensibly that she moved instinctively to save herself from falling. The general movement was also seen and felt by another person in the room.”—EDMUND RANDOLPH.

ROYAL VICTORIA HOSPITAL, NETLEY, SOUTHAMPTON.—“The first shock occurred here at 7 minutes to 12 o'clock exactly, and lasted about 5 or 6 seconds. It was sufficiently strong to cause the door to shake with some violence and many objects in the room continued to vibrate for a considerable time. The second shock occurred a few seconds afterwards, but lasted for a much shorter period.”—DOBSON.

CARLTON CRESCENT, SOUTHAMPTON.—“I was sitting in my drawing room on Monday morning, at 10 minutes to 12 o'clock, reading a newspaper, when I distinctly felt the shock of an earthquake—slight, but sufficiently perceptible to move the chair and to make some small ornaments in the room to jingle. Having experienced an earthquake fifty years ago, when quartered with my regiment in the neighbourhood of Lisbon, I feel that I could not be mistaken, the vibration caused by it being of so very peculiar a character.”—S. TRYON, Major-Gen.

SOUTHAMPTON.—At the upper part of the town, at the *Ordnance Survey Office*, which covers more than four acres of ground, and in which nearly 500 men are daily at work, the effects of the earthquake were perceptible in every department, particularly in that of the draughtsmen. The time of its occurrence was about five minutes to 12 at noon.

FAREHAM.—“The earthquake was distinctly felt here at precisely the same hour and for the same time as in Alderney. Sitting by the fireside reading, I felt the chair rock under me, and remarked to a young lady who was in the room at the time, and who was also sensible of the shock, that either this was an earthquake or that some very heavy guns were being fired at Portsmouth. The motion was sufficient to set some glass pendants on the chimneypiece swinging. The same tremulous motion was felt by a neighbour.”—ANON.

STODHAM PARK, LISS, NEAR PETERSFIELD.—“I was sitting before the fire on Monday morning, a few minutes before 12 o'clock struck, when I suddenly felt my chair violently tilted off the ground. Looking downwards immediately, I perceived that the floor appeared to be heaving, and the next minute the window shook violently.”—E. E. MONEY.

LYME REGIS.—“The shock of an earthquake was distinctly felt in Lyme Regis within a few minutes of 12 o'clock on Monday last. It was of sufficient force to set a bell ringing in the upper part of the house. A strong north-west wind was blowing at the time.”—W. J. A.

BOVEY TRACEY, DEVONSHIRE.—“Two distinct shocks of earthquake were felt here at a few minutes before 12 on Monday last.”—O. N. G.

ALDERNEY.—“A very distinct shock of earthquake, lasting about four seconds, was felt at eastern Alderney at 11.55 a.m. to-day (Monday).”—J. D. WILSON, M.D., Army Medical Staff.

JERSEY.—“Yesterday afternoon a powerful shock of earthquake was felt in the island of Jersey. It was so strong as to cause houses to totter and bells to ring.

Its course was from east to west. There was at the time a heavy gale from the south-west in the English Channel."

PARIS.—"Yesterday at noon, while sitting at my breakfast table, I was suddenly alarmed by a severe shaking of the house, and remarked that the water in a bottle close to me was being tilted up at least three-quarters of an inch. As there was no heavy cart passing at the time, I concluded that this was due to an earthquake shock, and noted the time as 11.58 a.m. During the day I asked different persons if they had felt any shock. As they had not and the newspapers made no mention of it, I thought I must have been deceived; but as I see to-day in your columns that a shock was felt yesterday at Jersey, and the French provincial papers report that shocks were felt towards midday at Havre and Rouen, I no longer doubt that what I remarked was the same movement."—*The Times* Correspondent.

This being the most southern report, we wrote to enquire within what limit of error the above reported time probably was. The writer kindly replied that it was Paris time, and if it erred it was because his clock was a little too fast, but that he does not think that it could have been so by more than two minutes. Hence we have for Paris the time as 11.56 to 11.58; or 11.47 to 11.49 Greenwich time.

Collecting now all the records of time, and expressing the term "a few minutes to 12" by "11.55?", we have the following result for the Greenwich mean time of the shock:—

11.45 to 11.50 Ryde, Isle of Wight.	11.55 Alderney, Southampton, Fare-
11.47 to 11.49 Paris.	ham, St. Leonards, Brighton,
11.48 to 11.50 Greenwich.	London.
11.50 Southampton.	11.57 St. Lawrence, Isle of Wight.
11.52 Greenwich.	11.55? Bovey Tracey, Lyme Regis,
11.53 Netley, near Southampton.	Osborne, Petersfield, Kew.
11.54 Jersey.	

Now, for the lessons we are to learn, they are few, easy, and oft-told tales:—

- I.—It is better to record the times of half-a-dozen slammed doors or heavy waggons passing, than to miss that of an earthquake shock.
- II.—It is most desirable in every possible way to ensure clocks being kept right. The above figures are mainly expressive of clock errors. No one can believe that the shock really occurred ten minutes earlier at Ryde than at St. Lawrence.
- III.—For the above reason the figures are not sufficient to demonstrate the position or depth of the centre whence the shock emanated, but it appears certain that it was south of Paris—possibly under Auvergne.

THE WINTERS IN ALGIERS.

To the Editor of the Meteorological Magazine.

SIR,—I have received only within the last few days that number of your Magazine in which appears my letter of October 1st, 1877. The corrections required in it are as follows:—Insert for May 28th a rainfall of .05 inch, which will make the total for May to be .29 inch.

It may be well also now to add details up to the end of June, which I had not received when I wrote my letter, viz. :—On June 6th, a fall of $\cdot 18$ inch ; on June 21st, of $\cdot 05$ inch ; which will, with the fall of $\cdot 05$ inch already put down for June 1st, make a total for June of $\cdot 28$ inch, and for the whole year, from July 1st, 1876, to June 30th, 1877, of 21 \cdot 08 inches.

While I am writing I will state also that the season of 1877–1878 has hitherto done its best to make up for the heat and drought of its predecessor. It has been, and is, cold for Algiers ; our rainfall from July 1st up to the present date is already 29 inches, comprising such items as—

3 \cdot 25 inches in 18 hours on Nov. 18–19 ;

3 \cdot 43 inches in about 24 hours on Dec. 14–15 ;

and, again,

3 \cdot 58 inches in about 40 hours on Jan. 11–12–13.

This last being an unusually heavy fall of snow on all the mountains. But the fine days, which have come liberally enough after these down-pours, have been fine in a manner extraordinary, even here ; so that on the whole, at least since Christmas, the weather has been favourable to invalids, and far more healthy and pleasant to the community generally than was the unnatural heat of last winter.

N.B.—In my letter of October 1st, for “ Algiers ” read “ Algeria ” the second time that word occurs.

Yours very sincerely,

H. A. BOYS.

Algiers, Jan. 29th, 1878.

PRE-INSTRUMENTAL METEOROLOGY.

WE have great pleasure in stating that the Rev. T. A. Preston, of The Green, Marlborough, has kindly offered to undertake the duties of Secretary and Editor for the purposes mentioned on p. 179 of our last number ; and not only has this offer been accepted, but two important sources have already been submitted to search, and one has been finished. The Saxon Chronicle is searched, and Holinshed is in hand. There is an ample field for all who are rather of a studious than of an observational turn of mind, for almost every parish register or county history will pay for search.

THE WEATHER IN JANUARY.

FROM the 1st to the 5th no very important disturbance occurred in the neighbourhood of these Islands. At first, pressure was highest over France, and a series of depressions passed north-eastwards across Western Europe, causing rather dull warm weather and south-westerly breezes. On the 4th, however, the barometer rose quickly in the North ; two regions of high pressure existed, one over the north of Scotland, the other over the south of France, whilst a large area of comparatively low readings lay over England and the Channel. During the night the mercury again fell in the north and west, but had risen elsewhere.

Readings remained uniform over England and France, but a slight depression was advancing towards the north-west of Scotland. This depression subsequently moved eastward across Scotland, the wind veered to the westward, and the barometer fell everywhere, with the exception of Valentia, where a recovery began.

Next day (6th) pressure was decreasing everywhere, except at a few places in the W.; in the N. the change was very brisk, and a large depression was apparently advancing from the north-westward along the Norwegian coasts. The highest readings lay in the S.W. Wind was westerly to west-north-westerly on all our coasts, but drew into S.W. in Denmark and the south of Scandinavia, and into S.E. at Christiansund; it was light in force in most other places, but blew freshly in the Irish Sea, at Stornoway, and Skudesnæes. In the evening of this day atmospheric pressure was still giving way everywhere, quickly in the N., and the wind was increasing in the W.

The depression noticed as advancing from the northward on the 6th had its centre over the Moray Firth on the 7th. A slight recovery had begun in its rear at Sumburgh Head and Christiansund, but everywhere else the mercury fell, the change varying from over half-an-inch on our N.E. coast to about one-tenth in the S.W. of France. Wind was north-easterly in the Shetlands, and northerly in the Hebrides, but was north-westerly to westerly elsewhere; at most places in the W. it was blowing freshly. During the day the depression continued to move southward, and at 6 p.m. had its centre near the Wash; in the N. the mercury rose briskly, with a north-easterly breeze and fine weather.

This depression continued its course in a southerly direction until it arrived at Toulon on the 9th, while the barometer was rising generally elsewhere.

On the 11th the mercury had fallen somewhat over the Gulf of Bothnia, but had risen everywhere else. A large area of high pressure (at the centre of which the barometer reached a height of 30.6 in.) lay over these Islands, the north of France, North Germany, and the North Sea.

Pressure was still increasing on the 12th over France, the greater part of England, and the countries to the eastwards of the North Sea, but on our western and northern coasts it was decreasing. Readings were highest over the mouth of the Channel (Jersey, 30.72 in.) whence they decreased to 30.33 in. at Stornoway, 30.26 in. at Toulon, and 30.09 in. at Haparanda. Temperature rose in all parts of these Islands, but had fallen several degrees in France, Biarritz, Rochfort, and Lyons, being 7° colder than London, and 20° colder than Stornoway. During the day the barometer fell quickly in the N.W. of Scotland; the southerly winds extended, and increased to a slight gale at Valentia and Stornoway.

From the 13th to the 16th, pressure was highest over Spain, the Bay of Biscay and the S.W. of France, and depressions passed from W. to E. to the northward of our Islands, giving us moderate to fresh westerly winds, accompanied by rather dull weather; a disturbance, which appeared near the Shetlands on the 16th, seems to have passed south-eastward; the area of high readings stretched northward to our S.W. coasts, and north-westerly breezes prevailed. On the 18th the anti-cyclone spread over the whole of these Islands and France, causing fog, cold weather, and very light airs. These conditions lasted until the 19th, when a brisk fall began in Ireland with a southerly breeze, a rise of temperature and rain.

During the five days, Jan. 20th to 25th, atmospheric pressure was highest over France, and a series of depressions passed from W. to E. across, or to the northward of, these Islands. These disturbances occasioned very steep gradients, and severe south-westerly to westerly gales were experienced all round our coasts. On the 25th, pressure increased in the S.W., and gave way over North Germany, so that gradients for north-westerly winds were formed, and breezes from that quarter were felt until the evening of the 26th, when a sudden fall in the W., and a rapid rise over Scandinavia caused a complete change in the distribution, bringing back southerly winds.

The weather for the remainder of the month was very quiet. On the 27th, pressure was increasing over Scandinavia, the South-East of England, North Germany, and the East of France, but decreasing on our Western and Northern

coasts. Readings were high both over the Gulf of Bothnia, and the South-East of France; low off the West coast of Scotland, and over North Germany. During the day, a distinct depression appeared off the West of Scotland, and the wind increased to a moderate gale at Aberdeen and Wick, and to a hard gale in the Shetlands.

On the 31st, pressure had increased over the whole of Western Europe, but was giving way slightly in the North of Scandinavia. It remained high (30·5 in.), and uniform over these Islands; while it was relatively low in the West of Norway and South-East of France. The wind was light on all coasts. Temperature rose over England, and on the Eastern shores of the North Sea; but fell elsewhere. Sky was moderately clear, and the weather was very dry. Snow fell at Nottingham, Cambridge, and Biarritz.

H. E. M.

BOOKS RECEIVED AND SHORT NOTICES THEREOF.

THE stream of meteorological literature still increases in volume, and improves in quality. It is hopeless for us to attempt to review fully all the works which come before us, and, therefore, from the present date we intend to adopt two new courses:—(1), Only to acknowledge serial publications once in each year; (2), to append to the title of all works which seem to call for it a few lines of comment, and to fully review only such books as imperatively need it.

AUSTRALIA.

ELLERY, R. L. J., F.R.S. *Results of Observations in Meteorology, &c. taken at the Melbourne Observatory during 1875.* 8vo. Melbourne.—A compact 8vo pamphlet, giving the daily mean and extreme observations at Melbourne, and abstracts of those made at about 40 subsidiary stations, of which, however, the majority appear to have no instruments except a rain gauge. Mr. Ellery retains for some of his tables the meteorological year commencing with December, 1874, and ending with November, 1875. This ought, if continued, to be distinctly stated, for as it is, it tends, with any but a careful reader, to discredit Mr. Ellery's accuracy, to read on p. 99, "Abstract for the year 1875," "Total rainfall for the year, 30·90 inches in 150 days," and on the very next page to find "Melbourne summary for the year 1875," "Amount of rain for the year 32·87." Both are true, but the former is for the old fashioned year, the latter for the civil year. Mr. Ellery adopts the wise course of prefixing to each volume a map showing the position of his stations.

MACDONNELL, E. *Meteorological Observations in Queensland during 1875 (from the Statistical Register of Queensland, 1875).* Fcap. folio.—There appear to be only two fully equipped stations in Queensland, viz., Brisbane and Cape Moreton, but there are fifty rainfall stations very fairly distributed. We should, however, be glad to see a map showing their precise positions, and also a column giving, at any rate approximately, the altitude of all the localities.

RINGWOOD, A. *Means by which the height of clouds can be obtained by one observer.* 8vo. Adelaide, 1877.—A very unassuming little tract of only eight pages, in which the author shows that—provided the distance of any well defined shadow, or spot of sunshine is determined, together with the position of the object causing it and the known altitude of the sun—it is easy for a single observer to ascertain and compute its precise altitude.

RUSSELL, H. C., B.A. *Meteorological Observations at the Government Observatory, Sydney, June–September, 1876.* 8vo.—The usual monthly reports from Sydney Observatory, giving full daily records (both in tables and diagrams) from that observatory, and abstracts from 44 subsidiary stations. On the 10th of September, 1876, Mr. Russell reports “Terrific gale from S.S.W. after 10.15 p.m. Velocity at 0.30 a.m. on 11th was at the rate of 153 miles per hour, being the greatest yet recorded. For 12 minutes it was at the rate of 112 miles per hour, and for 11 hours 57 miles per hour.”

AUSTRIA.

Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Dec. 1st. 1877–Feb. 1st, 1878. Large 8vo, Wien.—Although this periodical received a severe blow in the death of its senior joint-editor, Dr. Jelineck, we are glad to find that, under the judicious direction of Dr. Hann, it fully maintains its extremely high position. All who can read German, and who wish to be informed of what is going on among thoughtful meteorologists, ought to subscribe to the *Zeitschrift*.

BELGIUM.

HOUSSEAU, J. C., and BUYS BALLOT, C. H. D. *Observations Météorologiques faites aux Stations Internationales de la Belgique et des Pays Bas, July–Sept. 1877.* 4to.—Daily observations printed in extenso in accordance with the recommendation of the Conference. The stations in the sheets before us are :—

Flessingue, Lon. 3° 35' E, Lat 51° 27' N.	Maeseyck, Lon. 5° 48' E., Lat. 51° 6' N,
Maestricht, Lon. 5° 41' E, Lat. 50° 51' N.	Leeuwarde, Lon. 5° 50' E., Lat. 53° 12'.
Bruxelles, Lon. 4° 22' E., Lat. 50° 51' N.	Arlon, Lon. 5° 48' E., Lat. 49° 40' N.
Furnes, Lon. 2° 40' E, Lat. 51° 4' N.	Tilbourg, Lon. 5° 5' E, Lat. 51° 32' N.

HOUSSEAU, J. C. *Annuaire de l'Observatoire Royal de Bruxelles, 1878.* Small 8vo. Bruxelles, 1877.—A very interesting and useful volume. One article, entitled “*Table Chronologique des découvertes en Météorologie,*” though not perfect, is so valuable a storehouse of references respecting the history of the science that we purpose, if possible, translating it for the information of our readers.

LANCASTER, A. *Traits Caracteristiques du Climat de Bruxelles.*—This is an extract from the work just mentioned, and is a praiseworthy compact epitome of the climate of Brussels. We shall if possible quote the leading features in a subsequent number.

CANADA.

Sixth Report of the Superintendent of the Meteorological Office of the Dominion of Canada for the year 1876. 8vo. Ottawa, 1877.—

We regret to find this report issued by the acting superintendent, Mr. Carpmael, but we only regret it because that step has been rendered necessary by the illness of the Director, Professor Kingston. Respecting the report there is not much to say; the revised list of latitudes and longitudes, together with the map of the stations, remove one objection which we have previously made to these reports. In two respects we still desire an entire change; first, the system which requires the "Remarks on the combinations employed for obtaining mean temperature," is a bad one, and it would be far better to give merely the arithmetical mean of the daily maximum and minimum at each station; and, secondly, we read respecting the inspection of stations, "In many cases systematic errors have been committed which were detected on the station being inspected, and their occurrence prevented for the future, but which have, in many instances, made the past observations entirely useless, and in others seriously impaired the value." We cannot understand anyone printing such a statement as this and not saying *which* "past observations are entirely useless." As matters now stand, no one taking up the previous Canadian reports will know what to do with them. Outsiders cannot tell which returns are good and which are bad. Wise men will leave them all alone until the Canadian director follows the example of the United States Signal Office, of the Russians, and others, and publishes the results of his inspections whether they be favourable or the reverse.

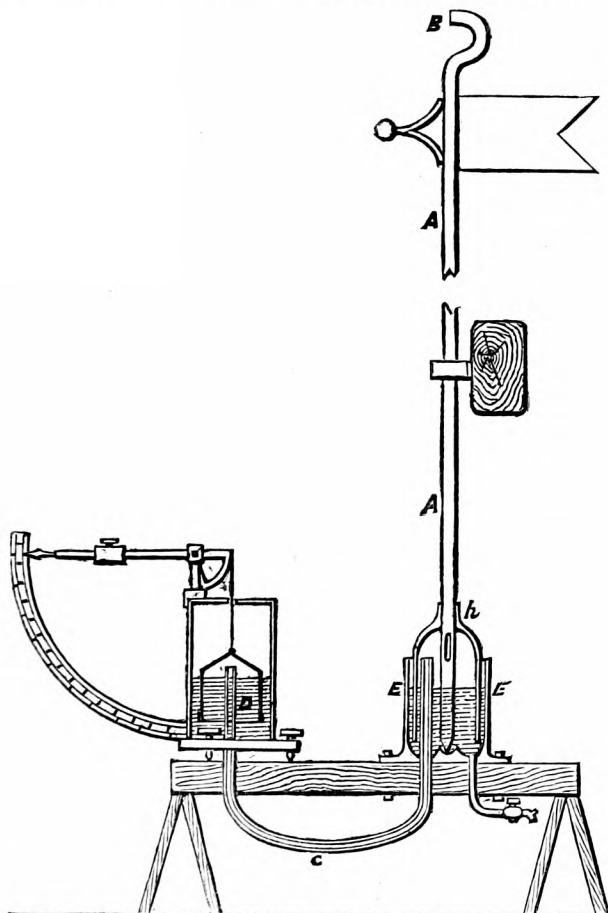
CEYLON.

FYERS, A. B., Lieut.-Col., R.E. *Results of Meteorological Observations in Ceylon, Aug.-Oct., 1877.* Single sheets, folio.—Monthly abstracts of observations at fourteen fully equipped stations, and of the rainfall at thirty-five others. It would be a great convenience to those not resident in the island if the authorities would supplement their numerical tables by a little letter-press, explanatory of the instruments employed and the mode of mounting them; this is especially desirable with respect to the grass minimum thermometers which show tremendous radiation. Moreover, either the latitudes and longitudes of the stations should be given, or a key map to show their positions.

DENMARK.

Bulletin Météorologique du Nord, publié par les Instituts météorologiques de Norvège, de Danemark et de Suède, Nov.-Dec., 1877. Oblong 4to.—The title of this publication is sufficiently explanatory; the three countries of Denmark, Norway and Sweden have joined in the publication of two observations daily for twenty-four stations, 8 in Norway, 7 in Denmark, and 9 in Sweden. When bound together at the end of the year the publication, which is entirely lithographed, is in almost all respects compact, handy and satisfactory.

HAGEMANN, G. A. *Om Vindmaalere*. Fcap. folio. Copenhagen, 1877.—This is an extract from Capt. Hoffmeyer's *Annuaire* for 1876, and, like the rest of that publication, is printed in Danish and in French, and fully illustrated. M. Hagemann had been studying the amount of draught in chimneys, and noticing how much it was affected by the velocity of the wind passing over the top, was induced to try various experiments with the view of obtaining a cheap and accurate anemometer. The result is shewn in the annexed figure.



The vane shaft A is hollow, the wind blows in at B, and so through C into the gasometer-like vessel D ; all the rest of the arrangements and the mode of indication are obvious from the sketch. Of course, this really is in principle an improved Lind's anemometer,* but it is inexpensive, and seems worth trial side by side with an Osler and a Robinson.

* *Met. Mag.*, Vol. II., p. 51.

Bidrag til Danmarks Klimatologi. Resultater af 15 aars Jagttagelser paa 4 Stationer. Fcap. folio. Copenhagen, 1877.—Another extract from Captain Hoffmeyer's 1876 *Annuaire*, giving the results of observations made at four stations during 15 years. We quote a few of the leading data, converting them into English measures :

Station.	Copenhagen.	Tarm.	Hindholt.	Smidstrup.
Latitude	55° 41' N. ...	55° 53' N. ..	55° 18' N. ...	57° 23' N.
Longitude	12° 34' E. ...	8° 32' E. ...	11° 35' E. ...	9° 55' E.
Altitude	43 ft. ...	22 ft. ...	150 (?) ft. ...	280 (?) ft.
Absolute Max. Temp. ...	90·5 ...	— ...	— ...	—
Mean daily Max. Temp. ...	51·8 ...	— ...	— ...	—
Mean daily Temp.	45·2 ...	45·0 ...	45·3 ...	44·2
Mean daily Min. Temp. ...	38·7 ...	— ...	— ...	—
Absolute Min. Temp.	13·0 ...	— ...	— ...	—
Days of Frost ..	98 ...	— ...	— ...	—
Mean barometer at 32° ...	29·863 ...	— ...	— ...	—
Absolute Max.	30·906 ...	— ...	— ...	—
Absolute Min.	28·245 ...	— ...	— ...	—
Total Rainfall	21·94 ...	26·02 ...	22·92 ...	26·20
Max. in 24 hours	1·96 ...	2·51 ...	— ...	—
Rainy Days	155 ...	152 ...	162 ...	134
Mean. direction of Wind. .	S. 42° W. ..	— ..	— ..	—

HOFFMEYER, N. *Le Foehn du Greenland.* 4to.—A clearly written paper, showing that the exceptionally high temperatures prevalent during S.E. gales on the west coast of Greenland may be perfectly accounted for by the same causes as Dr. Hann showed were the source of the Foehn, in the vicinity of the Alps.

FRANCE.

DAVY, M. MARIÉ.—*Annuaire de l'Observatoire de Montsouris pour l'an 1878.* Small 8vo. Paris : Gauthier-Villars.—This capital annual improves every year ; we cannot pretend to epitomize its contents, we therefore merely state that a copy can probably be had in London for two shillings, that it contains more than 500 pages of interesting meteorological matter, with more than 100 engravings. We are sure that no one who buys a copy will fail to thank us for advising them to do so.

DAVY, M. MARIÉ. *Bulletin Mensuel de Montsouris, July–Sept., 1877.* 4to. The daily observations at the observatory, printed in most valuable detail. The magnetic elements, pressure, hygrometer, direction of wind, evaporation, state of sky, electricity, and earth temperature are given for each three hours. The temperature, velocity of the wind, and amount of rain are given for each hour ; and analyses of the matter forming the dust of the atmosphere daily, and of rain and dew whenever they occur.

POEY, A. *Rapports entre les variations barométriques et la déclinaison du Soleil.* 4to.—A short note read before the Academie des Sciences de Paris, calling attention to the relation between the changes of atmospheric pressure and the declination of the sun. The result of

a discussion of the hourly observations at Havanna in 1862 [Have these observations ever been published?] and of various other records have led M. Poëy to the following conclusion—"I find that the low pressures follow precisely the course of the sun, while the high ones pursue an exactly opposite course."

GREAT BRITAIN.

AIRY, SIR G. B., K.C.B., &c. *Greenwich Magnetical and Meteorological Observations*, 1875. 4to, 1877.—The character of this volume is so well known to our readers that we confine our notice of it to repeating the suggestion, in which we concur, that the publication of the absolute values, even at one hour daily, would be very acceptable.

SUPPLEMENTARY TABLE OF RAINFALL IN JAN., 1878.

[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	1·69	XI.	Solva	2·32
„	Littlehampton	1·87	„	Castle Malgwyn	2·22
„	Hailsham .....	...	„	Nantgwilt, Rhayader	6·83
„	St. Lawrence, I. of W....	1·90	„	Carno	5·23
„	Strathfield Turgiss	·88	„	Rhug, Corwen	3·52
III.	Addington Manor	1·61	„	Port Madoc	4·10
„	Oxford	1·50	XII.	Carsphairn	7·33
„	Northampton	1·18	„	Melrose	3·16
„	Cambridge	1·36	XV.	Gruinart	5·24
IV.	Sheering	1·45	XVI.	Grandtully .....	...
„	Diss	1·83	XVII.	Tomintoul	1·89
„	Swaffham	2·00	„	Keith	1·53
V.	Alderbury, Salisbury ..	1·75	XVIII.	Dalwhinnie	1·35
„	Compton Bassett	1·99	„	Auchnasheen	9·33
„	Dartmoor	4·82	„	Springfield, Tain	2·20
„	Teignmouth	1·81	„	Glen, Finnan .....	...
„	Langtree, Torrington ..	2·97	XIX.	Watten	1·93
„	Cosgarne, St. Austell ...	3·83	XX.	Glenville, Fermoy	4·17
„	Taunton	1·14	„	Tralee	4·86
VI.	Bristol	1·58	„	Tipperary .....	...
„	Sansaw	1·76	„	Newcastle W., Limerick	3·85
„	Cheadle	3·24	„	Kilrush	3·83
„	Bickenhill Vicarage	1·90	XXI.	Kilkenny	2·69
VII.	Coston, Melton Mowbray	1·82	„	Kilsallaghan	2·24
„	Bucknall	1·76	„	Twyford, Athlone	3·62
VIII.	Walton, Liverpool	3·08	„	Mullingar, Belvedere ...	...
„	Broughton-in-Furness ..	5·74	XXII.	Ballinasloe	3·61
IX.	Stanley, Wakefield	2·08	„	Kylemore	8·86
„	Mickley, Ripon	3·87	„	Carrick on Shannon	5·93
„	Whitby .....	...	XXIII.	Rockcorry	3·90
X.	Gainford	2·07	„	Warrenpoint .....	...
„	Carlisle, Scothy .....	...	„	Newtownards	3·64
„	Shap	4·74	„	Bushmills	4·89
IX.	Llanfrechfa	2·99	„	Buncrana	5·13

JANUARY, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which -01 or more fell.	TEMPERATURE.				No. of Nights below 32°		
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.				
				Dpth	Date.		Deg.	Date.	Deg.	Date.			
		inches	inches.	in.								In shade	On Grass
I.	Camden Town	1·31	— ·64	·30	28	15	55·6	21	26·9	12	10	18	
II.	Maidstone (Hunton Court)...	1·20	— ·84	·44	28	8	...	...	...	...	...	...
III.	Selborne (The Wakes).....	1·47	— 1·80	·37	27	15	52·5	21	18·5	12	10	14	
IV.	Hitchen	1·51	— ·63	·35	27	19	53·0	21	24·0	10	16	...	
V.	Banbury	1·51	— ·58	·44	3	21	54·0	21	23·0	30	15	...	
VI.	Bury St. Edmunds (Culford)...	1·81	— ·06	·33	27	15	57·0	21	20·0	10	13	22	
VII.	Norwich (Sprowston).....	1·76	...	·37	23	22	...	...	...	...	...	...
VIII.	Bridport	1·63	— 1·56	·46	27	14	...	...	...	...	...	...
IX.	Barnstaple.....	2·92	— ·60	·62	23	19	56·0	22	23·0	31	...	...
X.	Bodmin	3·05	— 2·14	·56	24	20	55·0	22	23·0	3	5	8	
XI.	Cirencester	1·25	— 1·75	·42	3	16	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall) ...	2·02	+ ·12	·73	27	16	55·0	21	23·0	30	10	16	
XIII.	Tenbury (Orleton)	1·83	— ·70	·71	27	18	56·8	21	23·3	30	10	12	
XIV.	Leicester (Town Museum) ...	1·57	...	·48	27	19	55·9	21	26·0	25	6	19	
XV.	Boston	1·40	...	·47	27	14	55·0	21	25·0	26	12	...	
XVI.	Grimsby (Killingholme).....	2·08	...	·40	27	20	56·0	21	27·0	25	7	...	
XVII.	Mansfield .....	...	...	...	...	...	...	...	...	...	...	...
XVIII.	Manchester (Ardwick).....	3·76	+ 1·54	·63	15	20	55·0	21	26·0	30	7	...	
XIX.	York	1·15	— ·43	·55	27	...	...	...	...	...	...	...
XX.	Skipton (Arnccliffe)	7·96	+ 2·32	1·89	21	21	...	...	...	...	...	...
XXI.	North Shields	2·99	+ ·88	·83	21	17	53·0	20*	23·0	25	12	15	
XXII.	Borrowdale (Seathwaite).....	17·06	+ ·70	3·31	21	20	...	...	...	...	...	...
XXIII.	Cardiff (Crockherbtown).....	1·73	...	·35	27	17	53·5	21	28·0	31	7	...	
XXIV.	Haverfordwest	3·49	— 1·56	·48	3	17	54·0	21	22·5	31	7	11	
XXV.	Aberdovey	3·58	...	·92	27	22	57·0	4	28·0	10	6	...	
XXVI.	Llandudno.....	2·71	+ ·17	·45	27	18	57·9	21	28·0	25	1	...	
XXVII.	Dumfries (Crichton Asylum)	3·65	— ·54	·62	21	18	52·4	16	22·2	26	16	19	
XXVIII.	Hawick (Silverbut Hall).....	3·55	...	1·12	21	16	...	...	...	...	...	...
XXIX.	Glasgow (Cessnock Park) ...	5·34	+ 1·16	1·22	20	19	49·0	17	22·0	22	...	...
XXX.	Mull (Quinish)	5·92	...	·67	20	24	...	...	...	...	...	...
XXXI.	Loch Leven .....	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Tyndrum (Ewick)	9·97	...	...	...	...	...	...	...	...	...	...
XXXIII.	Arbroath	1·77	— ·75	·72	27	8	50·0	3	26·5	31	12	...	
XXXIV.	Braemar	1·27	— 1·86	·54	21	12	48·8	16	11·0	31	18	29	
XXXV.	Aberdeen	1·49	...	·52	27	16	52·5	15	24·4	25	12	27	
XXXVI.	Gairloch	4·39	...	1·01	14	22	...	...	...	...	...	...
XXXVII.	Portree	8·70	— 4·39	1·18	15	28	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden) .....	...	...	...	...	...	...	...	...	...	...	...
XXXIX.	Dunrobin	2·20	— ·45	·57	27	18	54·0	21	23·0	25	9	...	
XL.	Sandwick	3·76	+ ·47	·42	15	30	51·0	3	24·5	25	4	12	
XLI.	Caheciveen Darrynane Abbey	5·94	...	·90	23	24	...	...	...	...	...	...
XLII.	Cork	2·82	...	·51	23	16	...	...	...	...	...	...
XLIII.	Waterford	2·47	— 2·39	·32	3	21	54·0	16	23·0	11	7	...	
XLIV.	Killaloe	5·42	+ ·56	·62	3	19	55·0	21	21·0	10	5	...	
XLV.	Portarlington	2·68	— 1·33	·63	3	26	54·0	20	26·0	10	14	...	
XLVI.	Monkstown, Dublin	1·72	— 1·67	·65	3	14	58·0	22	22·0	31+	7	9	
XLVII.	Galway .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	4·26	...	·81	26	24	55·0	20	23·0	31	18	22	
XLIX.	Edenfel (Omagh)	4·23	...	·72	26	25	52·0	20*	24·0	31	16	...	
L.	Ballyshannon	5·24	...	1·10	26	22	...	...	...	...	...	...

* And 21.

+ 11.

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

METEOROLOGICAL NOTES ON JANUARY.

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.

CAMDEN SQUARE.—Extremely high temp. on the 21st and 22nd; min. on the latter day being $51^{\circ}0$.

SELBORNE.—A very foggy, damp month, with variable winds; S in the afternoon, and T and L in the evening of the 23rd.

BANBURY.—A good deal of high wind and fog during the month; S, H, T and L on the 23rd.

SPROWSTON.—About the average rainfall, no heavy amount any day, but a succession of slight storms throughout the month; a little S, but temperature above the average.

BODMIN.—Average temperature of the month $43^{\circ}3$.

SHIFNAL.—Unusually mild and moist up to the 24th, when frost set in, with 2 in. of S (producing $\cdot 23$ in. when melted), but changing suddenly to R on night of 27th, when $\cdot 73$ in. fell, then frost again (enabling us to fill our ice houses with ice 1 in. thick) till the close. Vegetation by no means forward, owing chiefly to the absence of sun. Bees out on the 21st, with ther. at 52° at 9 a.m. Throstle singing on the 3rd, aconites in flower on the 15th.

ORLETON.—Although the total fall of R in the month was much less than the average, the sky was generally clouded over and there was very little sunlight. The bar. was generally high, and on the 11th it stood at $30^{\circ}34$ (uncorrected). The temperature was very variable, but the mean of the month was nearly $3\frac{1}{2}^{\circ}$ above the average. The ground was covered with S on the 25th, followed by R, and there were frosts every morning of the last week.

GRIMSBY.—A fine month for the season; the frost at the close very serviceable in checking the precocious vegetation induced by the mild weather preceding; T and L at night on the 25th. Aconite in flower on 5th, primrose on 28th.

NORTH SHIELDS.—Lunar Halos on the 12th, 16th, and 18th; T heard on the 20th; L seen on the 25th.

SEATHWAITE.—L seen on 28th.

WALES.

HAVERFORDWEST.—Less R than usual for this month, but very damp, mild, and foggy; very little frost; S fell, completely covering the the Precelley range on the 25th; the S storm was accompanied by a severe N.W. gale; cold weather and rather sharp frosts; continued from this date to the end of the month.

ABERDOVEY.—Mean temperature for the month $43^{\circ}1$; heavy S on the 25th; fine, clear, and calm towards the close.

SCOTLAND.

DUMFRIES.—A cold, moist month, with an average rainfall and a low mean temperature; S fell on several occasions, but in this district the fall was light; winds in general were light, but violent gales from the N.W. were experienced towards the end of the month; these were followed by a sharp frost. Mean height of bar. above average.

HAWICK.—First half of the month very mild and spring-like; the latter half rather wintry; a very severe storm of wind and R on the 20th and 21st.

GLASGOW.—L, T, H and R on the 23rd.

BRAEMAR.—T and L on the 22nd.

ABERDEEN.—On the whole, a fine quiet, dry month, with fewer gales and much less S than usual but a good deal of hoar frost; mean temp. of month $37^{\circ}6$ or $0\cdot 5$ above mean of 21 years. Rainfall lower than mean of 21 years.

PORTREE.—A wet stormy month, with heavy falls of S on 24th and 28th, frost and sleet throughout the month; very unhealthy weather.

DUNROBIN.—On the 10th a peculiar colourless rainbow in the N.N.E, it lasted from 10 a.m. till 1.30 p.m., during the most of the last hour the sun was obscured by a film of clouds.

SANDWICK.—January was remarkable for the great number of days on which R fell, .01 or more having fallen every day, but the total was less than the mean of the previous 36 years; the weather was mild for the season, the ground being covered with S only one day (24th;) there were gales of from 50 to 55 miles an hour on the 14th, 21st, and 24th; aurora on 3 nights, but never bright.

IRELAND.

DARRYNANE ABBEY.—A mild month, and rainfall rather below the average; wind very variable, generally moderate, but strong gale from N.W. on 23rd, 24th, and 25th, veering to N.N.E. in the afternoon of the 25th; H on the 23rd and 25th, and a slight shower of S on the latter date.

WATERFORD.—Lunar halo and corona on 17th; L seen on 22nd, but no T heard.

KILLALOE.—The most remarkable meteorological feature of the month was the high range of bar. The readings being below 30.0 in. on only four days, lowest 29.72 on 24th. From 9th until 19th it varied from 30.50 to 30.55, and now, 4th February, is steady at 30.58; S on hills on 22nd.

WARINGSTOWN.—Mild, and until the 20th, not very wet, but the fall of that day and the next, with those of the 26th and 27th, thoroughly soaked the ground; the last 4 days fine and frosty, now succeeded by a mild thaw.

EDENFEL, OMAGH.—Weather wet, with but little intermission, frequent gales; centre fortnight abnormally mild.

BALLYSHANNON.—The first part of the month exceedingly wet and warm for the season; dry frosty weather during the latter part. with very high bar.; rainfall less than corresponding period in 1877, 2.45 in.

HULL RAINFALL.

MANY meteorological observers are in the habit of sending summaries of their observations for publication in local newspapers, some of them obtain slip copies for private distribution, and some have the tables, &c., set up solely for private circulation. Many of these communications are of such permanent interest and utility that their limited circulation is to be regretted. An exchange of such papers was once proposed, but that would involve much labour in addressing the copies, considerable expenditure for postage, and would after all only slightly enlarge the circulation. Another plan occurred to us while looking over the copy of the enclosed table, sent to us by Mr. Harold Smith, viz., print off a sufficient number of copies to enable us to forward one with every copy of this magazine. When a table is once set up, the extra cost for paper and printing is not large, and without any further outlay, circulation throughout the meteorological centres of both hemispheres is ensured. We submitted the proposal to Mr. Smith, he telegraphed his approval, and we trust that, inserted in this number, every subscriber will find a copy of his very compact and interesting abstract. Thanks to Mr. Smith's ready help, the proposal in its complete form is now before our readers, its adoption, of course, depends upon others, not upon ourselves.

RAINFALL AT HULL:

Results of 20½ Years' Observations on the Beverley Road.

YEARLY FALL.

Year.	Fall in Inches.	Days.		Inches.	Days.
1858	22.42	135	Average	25.65	179
1859	21.12	170	Wettest Year—1872	36.51	221
1860	31.74	205	Year with largest number		
1861	19.97	163	of Days—1877	29.33	222
1862	23.69	174	Driest Year—1864	18.27	152
1863	24.63	155	Year with least number of		
1864	18.27	152	Days—1858	22.42	135
1865	23.80	170			
1866	29.20	202			
1867	24.10	184			
1868	26.54	163			
1869	28.29	189			
1870	25.81	172			
1871	25.69	170			
1872	36.51	221			
1873	22.09	180			
1874	20.19	176			
1875	28.87	178			
1876	30.77	191			
1877	29.33	222			

AVERAGE YEARLY FALL IN EACH 5 YEARS.

Years.	Inches.	Days.
1858 to 1862.....	23.77	169
1863 to 1867.....	25.00	173
1868 to 1872.....	28.57	183
1873 to 1877.....	26.25	189

QUARTERLY FALL.

	Wettest Quarters		Average.		Driest Quarters.	
	Year.	Inches	Inches	Days	Year.	Inches
First Quarter ..	1872	8.60	5.17	48	1858	1.50
Second „ ..	1860	7.90	5.13	39	1874	3.14
Third „ ..	1866	11.25	7.73	39	1864	3.59
Fourth „ ..	1876	12.00	7.46	52	1857	2.08

The driest Fourth Quarter, 1857, was followed by the driest First Quarter; the total Rainfall for the six Months October, 1857, to March, 1858, being only 3.58.

—:0:—

Wettest Half-Year was the second half of 1872, with fall of 21.52.

MONTHLY FALL.

	Wettest Months.		Average.		Driest Months.	
	Year.	Inches	Inches	Days	Year.	Inches
January ..	1863	3.48	1.80	16	1858	.29
February ..	1872	2.65	1.51	15	1858	.26
March	1876	3.65	1.85	17	1875	.81
April	1877	3.73	1.59	12	1875	.47
May	1869	4.69	1.64	13	1859	.47
June	1860	4.32	1.89	13	1874	.57
July	1872	4.83	2.23	12	1869	.25
August	1857	5.96	2.86	13	1861	.45
September ..	1866	5.34	2.68	14	1865	.47
October.....	1870	5.79	2.51	17	1857	.79
November....	1875	5.76	2.46	17	1857-62	1.04
December ..	1868	6.45	2.47	18	1857	.25

Number of Days in which 1 Inch or more fell in the 20½ Years.

January	1
February	0
March	0
April	2
May	1
June	2
July	7
August	13
September.....	5
October	3
November	2
December	3

39

Heaviest Fall in one Day,
2.31 on August 14, 1867.

AVERAGE RAINFALL.

At Hull.....	25.65	At Blackpool. 32.45
„ Harrogate. 30.90		„ Clifton,
„ Malton .. 27.09		Bristol.... 33.11
„ Boston.... 22.70		„ Plymouth.. 43.28
„ Manchester 29.40		„ Seathwaite,
„ London .. 24.99		Cumberld. 144.83
„ Bolton 46.99		

Fall of Rain at the Styte, Head of
Borrowdale, in 1872, amounted to
243.98 inches.

HAROLD SMITH.

Hull, Feb., 1878.

: Days—by “Days” is meant the number of days in which any Rain was measured, without any reference to quantity.

A Fall of One Inch of Rain is equal to 100 Tons per Acre.

EXTRACT FROM THE TWENTY-SIXTH HALF-YEARLY
REPORT OF THE MARLBOROUGH COLLEGE
NATURAL HISTORY SOCIETY.

Latitude..... 51°26' N.

Longitude 1°43' W.

Barometer—A standard on Fortins' principle, brass mounted, suspended
474 feet above Sea Level.

Dry and Wet Bulb Thermometers—by Negretti and Zambra.

Maximum—Negretti's Patent.

Minimum—Rutherford's Construction.

In a Stevenson's Stand, the bulbs of the thermometer being 4
feet above the ground, and have all been tested at Kew.

Maximum Thermometer in the Sun's Rays—Negretti's latest patent,
on a post 4 feet above the ground.

Minimum on Grass—Negretti's latest patent.

Rain Gauge—472 feet above Sea level; the funnel 5 inches in diameter,
and 1 foot above ground.

The observations are taken at 9 a.m. and 9 p.m.

The garden in which the Thermometer Stand and Rain Gauge are
exposed is quite level, but is surrounded by low buildings on the south and
south-east, and by somewhat higher ones on the north; none, however, rise
above 25° and only in one point exceed 20°. The elevation of the greater
part is under 10°.

The "Mean Temperature" is the simple arithmetical mean of the
9 a.m. and 9 p.m. dry-bulb readings, combined with the maximum and
minimum for the day.

The velocity of the wind in miles is recorded by a Robinson's
Anemometer, in an exposed garden at the back of the High-street, and which
has been read twice daily.

The figures in column 20 give the velocity for the 24 hours ending
9 p.m.

1877.

SUMMARY.

Month.	Mean Reading of the Barometer (reduced to Sea Level.)	Temperature.						In the Shade.			In the Sun's rays.			Degree of Humidity (Saturation=100).		Wind.							Amount of Cloud.	No. of Days it fell.	Amount Collected.
		In the Shade.						Mean of all the Highest.	Mean of all the Lowest.	Adopted Mean.	Dew Point.	Mean of all the Highest in the Sun's rays.	Mean of all the Lowest on the Grass.	Direction. Proportion of											
		Highest.	Lowest.	Mean of all the Highest.	Mean of all the Lowest.	N.	N.E.							E.	S.E.	S.	S.W.	W.	N.W.	Velocity.					
ins.	ins.	53.3	28.8	47.9	36.5	42.0	38.9	66.0	33.6	94	2	1	1	0	9	6	9	3	7417	6.9	28	5.65			
January	29.845	53.3	28.8	47.9	36.5	42.0	38.9	66.0	33.6	94	2	1	1	0	9	6	9	3	7417	6.9	28	5.65			
February ..	.977	56.2	24.7	48.6	38.4	42.8	39.2	78.3	34.9	92	0	0	0	1	7	12	8	7350	7.2	19	1.61				
March .....	.789	57.8	20.8	47.9	33.6	40.2	35.5	87.5	29.1	87	4	2	0	2	3	3	12	5	4467	6.3	19	2.41		
April .....	.770	59.5	30.2	52.2	38.7	44.9	40.1	92.3	35.0	86	5	2	9	2	5	1	6	0	7105	7.9	19	3.67		
May	29.893	64.5	25.8	56.8	39.9	48.2	40.9	105.3	34.2	78	10	1	4	1	3	4	7	1	4074	6.7	14	2.59			
June	30.027	81.8	40.7	70.5	50.4	60.2	51.0	120.3	45.7	74	3	2	5	1	4	8	3	4	4944	5.2	8	1.12			
July	29.939	82.5	41.4	67.9	50.4	58.9	53.3	118.6	44.6	84	1	0	0	1	1	10	15	3	4082	7.0	20	5.03			
August	29.883	77.3	36.2	68.3	52.4	59.8	54.2	117.7	47.3	85	4	1	1	1	4	10	8	2	4008	6.4	17	4.81			
September ..	30.094	66.5	33.1	61.1	43.8	52.0	46.8	105.7	37.5	85	10	5	3	0	1	5	2	4	3409	6.0	6	2.95			
October	30.046	66.1	24.5	57.6	39.	48.3	43.3	94.4	31.0	88	5	4	2	0	2	12	5	1	5017	4.7	15	2.49			
November ...	29.690	57.4	31.2	51.5	38.1	44.3	41.1	80.4	29.6	94	0	1	0	1	3	13	12	0	7038	5.9	23	7.02			
December ...	30.074	51.9	26.7	45.1	34.6	39.3	36.9	62.8	26.3	95	2	0	0	0	2	7	17	3	3787	6.5	19	2.39			
Year	29.919	82.5	20.8	56.3	41.3	48.4	43.4	94.1	35.7	86.8	46	19	25	9	38	86	108	34	62698	6.4	207	41.74			

SUMMARY OF THE WEATHER FOR 1877.

JANUARY.

“A January spring is worth naething.”

The mild weather which was prevalent at the end of December, continued, with a slight exception from the 10th to the 13th, throughout this month; the mean temperature for the first 9 days being as high as $45^{\circ}5$. The maxima exceeded 50° on 10 occasions, while the minima only 5 times descended below 32° . The highest temperature during the month was $53^{\circ}3$ on the 19th, the lowest $28^{\circ}8$ on the 12th, and the mean $42^{\circ}0$.

Atmospheric pressure was subject to much fluctuation, and consequently brought wet and stormy weather. The lowest reading of the barometer was 28.712 in. at 9 a.m. on the 1st, the highest 30.653 in. at 9 p.m. on the 21st (a difference of nearly 2 inches), and the mean 29.845 in. Rain fell every day except on the 11th, 12th, and 22nd, the amount being 5.65 in. Fog occurred on 6 occasions, and lunar halos were seen on the 24th and 27th.

FEBRUARY.

“Who doffs his coat on winter’s day,
Will gladly put it on in May.”

The mild weather of the previous month continued during February, the last 3 days only being cold. The mean temperature from the 1st to the 19th was about 45° , the minimum during that interval not being lower than $32^{\circ}8$; the mean from the 26th to March 1st was, however, only $33^{\circ}6$. The highest temperature during the month was $56^{\circ}2$ on the 7th, the lowest $24^{\circ}7$ on the 28th; and the mean $42^{\circ}8$.

Atmospheric pressure was much more settled than last month, and from the 1st to the 9th was above 30 inches. The highest was 30.399 in. at 9 p.m. on the 28th, the lowest 29.260 in. at 9 a.m. on the 26th, and the mean 29.977 in. Rain fell on 19 days to the amount of 1.61 in. Fog occurred on the 8th and 9th; snow fell on the 22nd, 26th, and 27th; hail on the 19th and 20th; and a lunar halo was seen on the 24th.

MARCH.

"March many weathers."

This month consisted of short periods of alternate cold and mild weather; the temperature on the whole was below the average, the mean $40^{\circ}2$, the maximum $57^{\circ}8$ on the 30th, and the minimum $20^{\circ}8$ on the 1st. Frost on the grass occurred on 20 occasions.

Atmospheric pressure was rather low, especially during the latter part of the month; the mean was 29.789 in., the highest 30.420 in. on the 1st at 9 a.m., and the lowest 28.870 in. on the 25th, at 9 a.m. Rain fell on 19 days, and the amount measured was 2.41 in. Fog occurred on 4 days, and thunderstorms on 2, viz., 26th and 29th. Snow fell on the 7th, 9th, 10th and 16th, and hail on the 7th and 18th.

APRIL.

"Cloudy April, dewy May."

This was a very dull and cloudy month. The first half was mild and damp, and the latter half cool, with a prevalence of E. winds. The mean temperature from the 1st to the 15th was $46^{\circ}2$, and from the 16th to the 30th, $43^{\circ}0$. The highest temperature was $59^{\circ}5$ on the 22nd, the lowest $30^{\circ}2$ on the 17th, and the mean $44^{\circ}9$.

Atmospheric pressure was low, the mean being only 29.770 in.; the highest reading 30.267 in. occurred at 9 a.m. on the 20th, and the lowest 29.113 in. at 9 p.m. on the 4th. Rain fell on 19 days, the amount being 3.67 in.; on 3 occasions more than half an inch was measured. Hail fell on the 6th and 17th, and a lunar halo was observed on the 16th.

MAY.

"May; come she early or come she late,
She'll make the cow to quake."

This month was very cold,—the first week being especially so. Severe frosts occurred on the 4th, 5th and 6th, when the minimum temperatures were respectively $27^{\circ}7$, $25^{\circ}8$ and $28^{\circ}5$. The lowest temperatures in May during the last 12 years have been as follows:—

1865.	$33^{\circ}2$	1869.	$29^{\circ}1$	1873.	$26^{\circ}7$
1866.	$25^{\circ}7$	1870.	$26^{\circ}0$	1874.	$26^{\circ}4$
1867.	$25^{\circ}5$	1871.	$31^{\circ}1$	1875.	$38^{\circ}0$
1868.	$32^{\circ}3$	1872.	$29^{\circ}2$	1876.	$29^{\circ}8$

Intense frost occurred on the grass from the 1st to the 8th; on the 4th and 5th the minimum thermometer registered $18^{\circ}5$ and $17^{\circ}4$. The mean temperature for the first six days was as low as $40^{\circ}6$, and the mean for the

month was only $48^{\circ}2$; the highest $64^{\circ}5$ occurred on the 26th, and the lowest $25^{\circ}8$ on the 5th.

Atmospheric pressure continued low, but was not subject to any great fluctuations. The mean was 29.893 in.; the highest 30.422 in. occurred at 9 p.m. on the 1st, and the lowest 29.240 in. at 9 a.m. on the 28th. Rain fell on 14 days, the amount measured being 2.59 in. A solar halo was seen on the 27th.

JUNE.

“Calm weather in June

Sets corn in tune.”

This was the warmest month of the year. The mean temperature was $60^{\circ}2$, which is 12° higher than that for May, and more than 4° above the average of the past 12 years. The following are the mean temperatures for June from 1865 to 1876:—

1865.	$58^{\circ}5$	1869.	$52^{\circ}7$	1873.	$55^{\circ}3$
1866.	$57^{\circ}9$	1870.	$57^{\circ}6$	1874.	$54^{\circ}3$
1867.	$54^{\circ}9$	1871.	$52^{\circ}2$	1875.	$57^{\circ}6$
1868.	$57^{\circ}0$	1872.	$54^{\circ}8$	1876.	$57^{\circ}9$

The highest temperature $81^{\circ}8$ occurred on the 18th, and the lowest $40^{\circ}7$ on the 24th.

Atmospheric pressure was rather steady and above the average, the mean being 30.027 in.; the highest 30.276 in. occurred at 9 a.m. on the 28th, and the lowest 29.285 in. at 9 a.m. on the 1st. Rain fell only on 8 days, the amount being 1.12, half of which was measured on the 1st. Thunderstorms occurred on the 1st and 12th.

JULY.

“No tempest, good July,

Lest the corn look ruefully.”

With the exception of the last 3 days, this month was cold, the mean temperature being above 60° on 5 days only and then not exceeding $61^{\circ}2$. The mean for the last 3 days was $66^{\circ}5$. The highest temperature was $82^{\circ}5$ on the 31st, the lowest $41^{\circ}4$ on the 7th, and the mean $58^{\circ}9$.

Atmospheric pressure was slightly below the average, the mean being 29.939, the highest was 30.341 at 9 a.m. on the 9th, and the lowest 29.215 at 9 p.m. on the 14th. Heavy rain occurred on the 14th and 23rd, the amounts being 1.95 in. and 1.05 in. respectively; the total fall for the month was 5.03 in., with 20 rainy days. Thunderstorms occurred on the 6th and 7th, and Fog on the 30th and 31st. A lunar halo was seen on the 20th.

AUGUST.

“August ripens, September gathers in.”

This Month with the exception of from the 13th to the 20th was cool, but not quite so cold as the preceding month, the mean $59^{\circ}8$ being almost 1° warmer than that for July. The maximum temperature exceeded 70° on 9 occasions only, while the minimum was as many times below 50° . The lowest temperature was $36^{\circ}2$ on the 24th, when a frost occurred on the grass. The minimum temperatures for the last 12 years are:—

1865.....	$40^{\circ}2$	1869.....	$32^{\circ}4$	1873.....	$44^{\circ}3$
1866.....	$38^{\circ}7$	1870.....	$35^{\circ}2$	1874.....	$38^{\circ}9$
1867.....	$40^{\circ}1$	1871.....	$40^{\circ}4$	1875.....	$41^{\circ}2$
1868.....	$40^{\circ}3$	1872.....	$39^{\circ}1$	1876.....	$39^{\circ}8$

The highest temperature recorded in the month was $77^{\circ}3$ on the 23rd. Atmospheric pressure was low and somewhat unsteady; the mean was 29.885 in., the highest 30.201 in. at 9 a.m. on the 24th, and the lowest 29.397 at 9 p.m. on the 8th. The rainfall 4.81 in. was about two inches above the average and exceeded that of any August from 1865 to 1876. The number of rainy days was 17.

SEPTEMBER.

“And cold out of the north.”

This month was excessively cold, being nearly 8° lower than that of August, and considerably below the average. From the 21st to the 25th, the weather was exceptionally cold, the mean for these 5 days being as low as $46^{\circ}7$. The following figures may be interesting and will show the coldness of this month as compared with the Septembers of the past 12 years.

Year	Maximum.	Minimum.	Mean.	Mean.	Mean.
			Maximum.	Minimum.	
1865	$82^{\circ}5$	$35^{\circ}2$	$73^{\circ}4$	$49^{\circ}3$	$60^{\circ}5$
1866	$65^{\circ}8$	$37^{\circ}1$	$60^{\circ}9$	$48^{\circ}9$	$53^{\circ}9$
1867	$76^{\circ}7$	$32^{\circ}4$	$64^{\circ}0$	$48^{\circ}2$	$55^{\circ}4$
1868	$85^{\circ}5$	$38^{\circ}8$	$67^{\circ}3$	$47^{\circ}6$	$56^{\circ}7$
1869	$73^{\circ}2$	$31^{\circ}9$	$64^{\circ}4$	$48^{\circ}9$	$55^{\circ}8$
1870	$70^{\circ}0$	$31^{\circ}1$	$65^{\circ}4$	$43^{\circ}0$	$53^{\circ}6$
1871	$78^{\circ}0$	$34^{\circ}0$	$62^{\circ}6$	$47^{\circ}8$	$54^{\circ}4$
1872	$76^{\circ}6$	$30^{\circ}2$	$63^{\circ}6$	$47^{\circ}8$	$54^{\circ}7$
1873	$70^{\circ}8$	$36^{\circ}5$	$61^{\circ}4$	$45^{\circ}8$	$52^{\circ}6$
1874	$74^{\circ}2$	$39^{\circ}2$	$63^{\circ}4$	$49^{\circ}0$	$55^{\circ}4$
1875	$78^{\circ}0$	$41^{\circ}2$	$68^{\circ}2$	$50^{\circ}8$	$58^{\circ}8$
1876	$71^{\circ}5$	$40^{\circ}8$	$63^{\circ}8$	$48^{\circ}7$	$55^{\circ}6$
1877	$66^{\circ}5$	$33^{\circ}1$	$61^{\circ}1$	$43^{\circ}8$	$52^{\circ}0$

Atmospheric pressure was high and not subject to much variation; the highest was 30·419 in. at 9 a.m. on the 27th, the lowest 29·738 in. at 9 a.m. on the 3rd, and the mean 30·094 in. The rainfall was 2·95 of which 0·51 was measured on the 2nd, 1·23 on the 3rd, and 0·87 in. on the 11th. The month was dry, there being only 6 rainy days. The general direction of the wind was from the North. Fog occurred on the 27th to the 30th.

OCTOBER.

“The dews of the evening industriously shun,
They’re the tears of the sky for the loss of the sun.”

The cold weather of September continued during the early part of this month; from the 20th to the 31st the weather was much milder. The highest temperature 66°1 occurred during the gale on the evening of the 14th; the mean for the month was 48°3, and the lowest 24°5 on the 18th. The nights were for the most part clear, and consequently radiation from the earth was great, the mean minimum temperature on the grass being 8°2 lower than in the air.

Atmospheric pressure was above the average, the mean being 30·045; the highest was 30·688 in. at 9 a.m. on the 6th, and the lowest 29·266 in. at 9 a.m. on the 25th. The first part of the month was dry, but rain fell every day from the 20th to the 30th, the total number of rainy days was 15, and the rainfall 2·49 in. Fog occurred on 8 days and hail on 1; lightning was seen on the 16th, a solar halo on the 6th, and a lunar rainbow on the 24th.

NOVEMBER.

“Untimely storms make men expect a dearth.”

The milder weather which set in at the latter end of October continued throughout the greater part of this month. The mean temperature was 44°3; the highest 57°4 occurred on the 1st and the lowest 31°2 on the 26th.

This was for the most part a dull wet and stormy month. The gale on the 11th was most severe, the reading of the barometer—28·664 in. at 9 p.m.—exceptionally low, and the rainfall 1·65 in. excessive. The rainfall for the month 7·02 in. was very great and nearly 4 inches above the average of the past 13 years. The following is the rainfall in November from 1864:—

	in.		in.		in.
1864.	3·15	1869.	2·57	1874.	3·52
1865.	3·82	1870.	2·04	1875.	4·33
1866.	3·04	1871.	0·69	1876.	4·34
1867.	1·48	1872.	5·23	1877.	7·04
1868.	1·65	1873.	3·29		

Atmospheric pressure was very unsettled and much below the average, the mean being only 29.690.

Rain fell on 23 days and hail on 1. Fog occurred on 6 days, thunder on 1, and lightning on 3. Lunar halos were seen on the 14th, 17th and 23rd, and lunar rainbows on the 14th and 22nd.

DECEMBER.

"The Ivy and Holy Berries are seen,
And Yule Log and Wassail come round again."

This month was mild, the only cold weather being from the 25th to the 28th, when the mean temperature was 32°6. The highest temperature during the month was 51°9 on the 6th, the lowest 26°7 on the 26th, and the mean 39°3.

Atmospheric pressure was high, that from the 14th to the 21st being especially so; the mean for the month was 30.074 in., the highest 30.695 in. at 9 a.m. on the 20th and the lowest 29.273 at 9 a.m. on the 1st. Rain fell on 19 days amounting to 2.39. Fog occurred on 7 days and snow on 3.

TABLE SHOWING THE MONTHLY AND YEARLY RAINFALL AT
MARLBOROUGH—1864 TO 1877.

Years.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Totals.
1864	—	—	3·27	1·92	1·54	1·63	0·65	0·52	2·46	1·95	3·15	2·14	—
1865	3·80	2·27	1·16	0·97	2·55	2·79	2·51	3·90	0·28	7·25	3·82	2·39	33·69
1866	4·32	3·79	2·26	2·32	1·87	3·17	1·55	2·97	6·97	1·74	3·04	3·24	37·24
1867	4·02	2·48	3·77	2·79	2·39	1·66	3·99	2·53	2·28	3·48	1·48	1·58	32·45
1868	5·34	2·21	1·84	2·61	1·52	0·46	0·98	4·78	5·05	2·74	1·65	5·71	34·89
1869	3·77	2·52	1·53	1·54	4·03	1·23	0·75	1·55	5·72	2·01	2·57	3·69	30·91
1870	1·89	2·44	2·10	0·55	2·14	0·36	1·75	1·91	1·29	4·56	2·04	2·51	23·54
1871	2·93	1·51	1·63	3·85	1·00	2·99	3·63	1·18	6·22	1·88	0·69	2·49	30·00
1872	6·84	2·64	2·40	2·01	2·32	3·41	2·64	2·33	1·09	5·66	5·23	5·52	42·09
1873	4·13	1·53	2·62	1·26	1·89	1·62	2·15	2·70	2·96	2·68	3·29	0·88	27·71
1874	3·17	2·67	0·97	1·78	0·68	1·25	1·47	2·57	4·65	4·64	3·52	2·78	30·15
1875	4·53	2·13	1·33	1·64	2·51	2·78	5·60	2·12	3·78	7·64	4·33	1·31	39·70
1876	2·51	3·11	4·20	3·41	0·98	1·98	0·88	4·75	6·88	1·67	4·34	7·20	41·91
1877	5·65	1·61	2·41	3·67	2·59	1·12	5·03	4·81	2·95	2·49	7·02	2·39	41·74
Means 13 years.	4·07	2·38	2·17	2·19	2·04	1·91	2·53	2·93	3·85	3·72	3·31	3·21	34·31

TABLE SHOWING THE NUMBER OF DAYS OF RAIN AT
MARLBOROUGH, 1864 to 1877.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Augt.	Sep.	Oct.	Nov.	Dec.	Totals.
1864	—	—	16	12	12	18	8	11	26	13	18	12	—
1865	18	18	11	9	18	5	14	17	2	22	19	13	166
1866	23	22	15	18	10	16	12	20	26	16	16	20	214
1867	17	21	21	21	12	12	18	11	15	21	7	10	189
1868	14	12	18	13	8	3	4	15	12	16	13	27	155
1869	15	19	15	12	18	9	9	11	19	13	19	22	181
1870	14	12	14	2	9	4	10	10	10	19	11	13	128
1871	18	15	10	16	6	15	20	7	14	18	9	15	163
1872	27	22	14	13	18	17	10	15	16	21	22	25	220
1873	22	12	20	13	14	11	16	17	15	16	17	9	182
1874	17	17	13	12	11	9	11	15	16	21	19	14	175
1875	23	13	8	11	13	18	13	13	17	17	18	16	180
1876	11	20	20	19	6	9	8	12	24	14	17	22	182
1877	28	19	19	19	14	8	20	17	6	15	23	19	207
Means 13 years.	19	17	15	14	12	10	13	14	15	18	16	17	180

TABLE SHOWING THE GREATEST FALL OF RAIN WITH THE DATE IN EACH MONTH AT
MARLBOROUGH, 1864 TO 1877.

Years.	Jan.		Feb.		March.		April.		May.		June.		July.		August.		Sept.		Oct.		Nov.		Dec.	
	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.	Max.	Date.
1864.....	—	—	—	—	96	6	60	17	54	5	39	10	25	3	21	9	55	16	69	21	66	24	79	8
1865.....	67	26	56	16	47	4	31	18	53	8	83	29	49	31	87	23	17	20	166	16	118	19	56	28
1866.....	62	10	62	11	54	23	60	28	73	26	83	30	40	2	79	29	90	1	42	21	86	13	68	5
1867.....	70	7	38	5	68	13	54	14	67	20	35	2	71	16	56	15	93	2	57	9	107	30	72	1
1868.....	99	21	82	29	46	7	84	19	35	19	33	21	36	12	118	17	103	29	60	28	47	21	52	7
1869.....	76	28	64	11	48	19	38	14	115	18	34	13	28	28	41	2	88	30	63	1	114	27	84	16
1870.....	28	11	91	6	65	1	36	9	77	11	23	16	85	31	61	27	36	8	71	22	56	24	73	13
1871.....	72	15	28	9	47	9	101	18	49	27	59	17	124	10	35	17	130	29	36	17	39	14	56	19
1872.....	92	23	39	22	67	28	49	27	36	13	53	6	115	25	67	7	27	1	106	24	57	4	111	16
1873.....	110	17	45	23	73	15	28	16	41	3	51	28	83	12	37	28	63	1	59	12	94	1	28	31
1874.....	58	18	88	25	10	{18 } 29	52	8	24	7	29	23	41	26	36	11	91	2	117	5	140	27	76	7
1875.....	56	1	62	6	57	6	34	6	58	28	54	13	232	14	97	12	83	21	132	9	79	13	35	2
1876.....	151	21	52	14	58	11	65	20	63	22	60	15	31	31	94	20	164	5	47	6	80	27	91	7
1877.....	84	6	36	19	37	23	55	3	47	12	56	1	195	14	90	14	126	3	51	29	165	11	53	28

SYMONS'S

MONTHLY

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OBSERVATIONS ON THE DIRECTION OF THE MOTION OF CLOUDS.

LONG before the commencement of the important researches of Hildebrandsson and of Ley, upon the relations which exist between the paths of cyclonic areas and the directions of cirrus clouds, we had called attention to Goddard's cloud mirror, and urged its general use. But it is very difficult to induce people to obtain and to use any instrument except barometers, thermometers, rain gauges, and anemometers. And although Goddard's mirrors were exhibited in the 1851 exhibition, and are mentioned in the catalogues of two opticians, no one keeps them in stock, and we do not know of a single one being regularly used in the British Isles. Mr. Stevenson described another form of the apparatus in 1855 (and sent one to the Loan Collection), but we have never seen any results obtained with it published. M. Marié Davy has among his beautiful collection of meteorological apparatus at Montsouris another form, which is thus described in the work which we strongly recommended to our readers last month, viz., *Annuaire de l'observatoire de Montsouris pour l'an 1878* :—

“The direction of cirri being under investigation by M. Hildebrandsson, of Upsala, we have established in the park, a horizontal mirror upon which the 16 principal wind-points are engraved. In order to determine the direction of motion of a cloud, the observer so places his eye that the image of the cloud appears in the centre of the mirror at the intersection of the various engraved lines; he then places a small cone upon the mirror in such a position that the point of the cone is projected on the same central point, and thus secures a sufficiently exact line of sight. A few minutes afterwards, on bringing the eye to the same position, it is easily seen in what direction the cloud has moved. The effects of perspective being the same on the sky as on the mirror, do not affect the observation.”

We are glad to find that the subject is receiving further attention on the continent. In the *Zeitschrift* for January 1st, 1878, there is a very interesting note by Herr Linss, of Darmstadt on Braun's nephoscope and on cloud observations in general. (Ueber eine veränderte Einrichtung des Braunischen Nephoskops und über Wolken-

beobachtungen in Allgemeinen.) He begins by stating that he has not seen the report of the decisions of the meetings at Vienna and Utrecht, but is willing to improve his own observations in conformity with the decisions then arrived at. We do not think that he will gain much by perusing the reports; his ideas and his practice in this matter are far ahead of those discussed at the above meetings. He has up to the present time made three observations per diem, viz., 8 a.m., noon, and 4 p.m. He adopts Poey's classification, and uses an improved form of Braun's nephoscope (*Νεφος* a cloud, and *σκοπεῖν* to see), which seems superior to all three forms of cloud mirror above described, inasmuch as by it, the velocity of a moving cloud can be determined as well as its direction of motion.

Although Herr Linss's observations do not yet extend over a long period, he has already obtained some interesting results, for instance, that the apparent velocity of cumuli, palliocirri, and cirrocumuli is greater at 8 a.m. than at the two subsequent observation hours, and as there is no such increase in the velocity of the wind, he concludes that those clouds are lower at 8 a.m. than later in the day. He also found a constant relation between the angle which the path of the cirrocumuli and palliocirri formed with that of the cumuli and the change of the course of the latter during the subsequent four hours, whence he further found that the changes in the upper strata of the air occur at least four hours earlier than in the lower ones. From other observations he traces distinct connexion between the direction of cirri and the movement of depression centres, and also evidence of the more rapid advance of the upper portion of those depression centres—or, in other words, of the fact that the axis of a cyclone is not vertical, but that the upper end is in advance of the lower—being, we presume, merely another way of stating that the lower part of a depression centre is prevented by the greater density of the air, and by friction against the earth's surface, from moving so rapidly as the upper part.

We have given a mere outline of Herr Linss's paper, but we commend it to thoughtful men, and trust that, having shown how much a cloud mirror may teach, a few observers will try to learn.

BOOKS RECEIVED, AND SHORT NOTICES THEREOF.

ENGLAND.

Army Medical Department Report for the year 1876. 8vo. 1877. —Contains abstracts of mean and extreme results from twelve foreign stations of the British army, viz., Gibraltar, Malta, Scutari, Barbadoes, Jamaica (2), Bahamas, Bermuda, Singapore, Hong Kong, Natal, and Sierra Leone. There is no letter-press referring to Meteorology, nor even any remarks from any of the stations.

CHAMBERS, C., F.R.S., and CHAMBERS, F. *On the Mathematical Expression of Observations of Complex Periodical Phenomena, and on Planetary Influence on the Earth's Magnetism.* (From the Phil. Trans.

of the Royal Society.) 4to, 1875.—The nature of this very elaborate paper is sufficiently indicated by the title, and by the first paragraph, which is as follows:—"The writers purpose in the following pages to determine by Bessel's method a mathematical expression for a periodical phenomenon from observations which are affected by one or more other periodical phenomena; and to find criteria for judging of the extent to which the expression is affected by these other phenomena; also, having found an expression for a period of known approximation to the truth, to find from it the expression for the true period. In the course of these inquiries certain ambiguities which affect similarly Bessel's expression for a single periodical phenomenon, and the results here arrived at, will be remarked upon; and, finally, the results will be applied to determine the nature of periodic planetary magnetic influence in particular cases."

CHAMBERS, C., F.R.S., and CHAMBERS, F. *The Absolute Direction and Intensity of the Earth's Magnetic Force at Bombay, and its Secular and Annual Variations.* (From the Phil. Trans. of the Royal Society.) 4to. 1876.

CHAMBERS, F. *The Diurnal Variations of the Wind and Barometric Pressure.* (From the Proceedings of the Royal Society.) 8vo.—The general character of this paper, like that of Messrs. C. and F. Chambers, is fully explained by quoting the first and second paragraphs, and one from near the end of the paper.

"In a paper which was read before the Royal Society in 1873, and which was honoured with a place in the 'Philosophical Transactions' of that year, I discussed the diurnal variations of the wind and barometric pressure at Bombay, and deduced therefrom the fact that a system of diurnal wind-currents moves synchronously with the diurnal variation of barometric pressure. Reasons were given for believing that that system of diurnal wind currents is a universal phenomenon; and on that hypothesis I showed how the diurnal variations of the barometer could be explained as a result of those currents.

"I have lately examined closely the 'Discussion of the Anemometrical Results furnished by the self-recording Anemometer at Bermuda, which forms Appendix II. of the 'Quarterly Weather Report of the Meteorological Office, London,' July to September, 1872. Those results support the conclusions arrived at in my former paper in such a remarkable manner as to justify the re-advancement of some of them in a form which will prominently exhibit their relation to the diurnal variation of the barometer.

"Fig. 12, which is formed simply by the addition of the ordinates of figs. 10 and 11, so closely corresponds to those derived from actual observation of the barometer, and its range approximates so nearly to the actual diurnal range of the barometer in low latitudes, as to leave little room to doubt that the true explanation of the large features of the diurnal variation of the barometer is to be found in the diurnal variation of the wind."

Meteorological Office: Quarterly Weather Reports, January-March and April-June, 1875. 4to. 1877.

Meteorological Observations at Stations of the Second Order, for the year 1876. Part I., January to August. 4to. 1877.

Charts and Remarks to accompany Monthly Charts of Meteorological Data for nine Ten-degree Squares.

Respecting the first of these works, the only points to which we need

call attention is the commencement of the publication in extenso of the records of several private English and Irish stations, some offered to the office by the observers, and others supplied by the Meteorological Society. By accident there is no statement of the year of which data are given, in appendix 1A, from pages [57] to [75] inclusive, they evidently are the values for 1875. Concerning Captain Toynbee's fine volumes of Charts and Remarks, we have only space here to report them as vast storehouses of facts, very well arranged, except the notes upon meteors, which would have been more useful if sorted according to date of appearance. A discussion of the observations made at Ascension by the late Lieut. Rokeby, R.N., forms an appropriate appendix.

KAY, JAMES. *The Meteorology of Bute for the year ending Jan. 31st, 1877. With an Appendix containing Abstract of Observations taken from records kept at the Old Cotton Mills, Rothesay, from 1800 to 1875.* 8vo. Rothesay, 1877.—This is a valuable little pamphlet, the appendix containing three important tables. The first gives the fall of rain in every month for the present century, except those of the last two years. As printed, it reports the observations for April, 1842, to be missing; but the fact is the fall in that month was probably too small to be measured; several stations in the S.W. of Scotland report "no rain" for that month. There is only one drawback to this record, the gauge was moved once, and at present no one seems to know in what year—otherwise the record would have been invaluable—even now it is very precious. Table II. gives the mean temperature of each month from 1828 to 1875. It appears from the text that the temperature was observed hourly, day and night, for many years; and that the records 1840-75 are in possession of the Archæological and Physical Society of Bute, having been presented to it by Mr. Kay. Table III. gives the max. and min. temperature in each month from 1828 to 1875; the absolute max. was 85° , mean $46^{\circ}5$ (this value would be much higher but for low temperatures reported between 1835 and 1844); absolute min. 12° . The tables appear to have been very carefully printed, though there is one very prominent error on p. 19, where 80° in 1846 is reported as the absolute max., instead of 85° in 1847.

Report of the Kew Committee for the Year ending October 31st, 1877. 8vo.—We are glad to note two or three improvements in this report. In the first place, we see with satisfaction that the composition of the Committee is no longer concealed; there was certainly no reason why the Kew Committee should be a secret one, and those who discharge honorary but influential duties ought to be known, and to be ready to assume individually the responsibility for their actions. Secondly, we are glad that the report contains abstracts of some of the meteorological results obtained at the observatory. We think it open to question whether the existing arrangement should continue by which the work of the observatory, instead of appearing in one annual

report as is the case with all other observatories, is scattered about in separate papers in the Proceedings of the Royal Society. It prevents anybody realising the amount of work done at Kew, and it renders the annual report a terrible collection of skeletons. Moreover, we doubt the advisability of heavy investigations being conducted at the observatory, and at its cost, and then being communicated to the Royal Society by Mr. XYZ. Of course, Mr. XYZ duly acknowledges his obligations to the Kew Committee for the materials supplied, but we submit that the information should not be scattered but concentrated; and if Mr. XYZ likes to help the Committee by contributing a paper to their report, by all means let him do so, and thus he will tend to render the annual report less insignificant as compared with the work done in the establishment than has hitherto been the case.

Report of the Meteorological Committee of the Royal Society for the period of Seventeen Months ending 31st May, 1877. 8vo, 1877.—The Meteorological Committee being dead, we are reminded of the mottos "*Nil nisi bonum de mortuis*," and "*Le Roi est mort, vive le Roi*," for the extinction of the Meteorological Committee was concurrent with the appointment of the Meteorological Council, and we sincerely hope, and are inclined to believe that the change will lead to less war-like relations than those upon which we have been obliged to comment in past years, and to the adoption of more liberal views than have previously prevailed. No stronger indication of probable future peace could be afforded than by the fact mentioned by some of our contemporaries, that the Secretary of the Scottish Meteorological Society has accepted an appointment under the new Meteorological Council. This is burying the hatchet pretty deeply, and we are very glad to record it. We need not say more about the report than that it is chiefly an index to the data accumulated in the office.

The Natural History Journal. December, 1877. 8vo. York.

The Observatory. January and February, 1878. 8vo.

—Recent numbers of these periodicals having been reviewed we need only say that they maintain their good characters.

TOYNBEE, CAPT. H., F.R.A.S. *On the Great Hurricane, the Tracks of American Storms, and the Ordinary Winds of the N. Atlantic, in August, 1873.* 8vo. 1877.—Captain Toynbee is always at his best when dealing with Atlantic storms, and this short paper is another proof that such is the case. As he promises a larger work upon the same subject we reserve further remarks, except to quote a foot note from page 23,—“An instrument to record the height, direction from, [*sic*, probably should be “direction, form”] and speed of clouds would be a great boon to Meteorology.” We think so too; that is why we have often urged the use of Goddard’s Cloud Mirror, and we refer Capt. Toynbee to the first article of this number.

Watford Natural History Society Transactions. December, 1877. 8vo. Watford, 1877.—This vigorous young society continues to pros-

per, and the above number of the journal is rendered especially useful to meteorologists by the insertion of a short but very satisfactory series of instructions for taking meteorological observations by W. Marriott, Esq., F.M.S., Ass. Sec. Met. Soc.

HAMBURG.

NEUMAYER, Dr. *Deutsche Seewarte. Monatliche Übersicht der Witterung. June and July, 1876, and February, March, July and August, 1877.* Large 8vo.—A very able and full summary of the weather of north-western Europe, compiled by Dr. Neumayer (who was for many years Director of the Observatory at Melbourne, Australia). It is a valuable store of facts, and is also noticeable as, to the best of our knowledge, the only publication giving charts of the progress of storm centres, *i.e.*, charts on which the position of the centre of depression-systems are marked for each day, and the positions of those which can be identified are united by a strong line. For instance, on the morning of August 6th, 1877, a depression centre existed in the Atlantic about 20° W. and 54° N., the minimum being 29 in. ; on the 7th it had moved eastward to about 17° W., the minimum being 29·06 in. ; in the evening it was a little further S. and E. (about 14° W. and 52° N.), with a min. of 28·94 in. On the morning of the 8th it was near Cork, and the min. still 28·94 in. ; during the day it crossed the Irish Channel, and was over central Wales in the evening. Next morning (9th) it had passed some miles eastward of the Yorkshire coast, and had so "filled up" that the min. was 29·33 in. ; here it received a check, and was turned from its original easterly course and sent north-westwards, so that in the evening the centre was in Kincardineshire, and finally it was between the Orkney and Shetland Isles on the morning of August 10th. The utility of such a publication is so evident that we do not attempt to support it, all argument is superfluous.

HOLLAND.

HELLMANN, Dr. G. *Feuchtigkeit und Bewölkung auf der Iberischen Halbinsel.* Oblong 4to. Utrecht, 1877.—This is an excerpt copy of a valuable paper upon the humidity and cloud of Spain and Portugal, written by Dr. Gustav Hellmann, of Berlin, and published by Dr. Buijs Ballot in the Netherlands Meteorological Jaarboek for 1876. After a brief introduction and quoting the works whence he had obtained the data subsequently employed, Dr. Hellmann gives the mean hourly elastic force of vapour and relative humidity for each month for San Fernando, Lisbon, Coimbra and Madrid. This answers two purposes : it shows the general laws of hygrometric variations at four typical stations, and it shows to what extent it is possible to reduce observations, made say at 9 a.m. and 3 p.m., to true daily values. After these come a series of very solid tables, giving monthly elastic force of vapour and humidity at 18 stations for periods of about 12 years at each, and various abstracts formed from them. The cloud observations are given in similar detail ; but there are here a few

points we cannot pass even temporarily without notice—such, for instance, as the fact that the average number of days with wholly overcast sky which, at Valencia is only 42, and Seville and Palma does not exceed 50, is at eleven stations more than 100, and at Bilbao and Oviedo 158 and 164 respectively. These numbers agree very well with the mean amount of cloud, which is only 2·1 at Valencia, 3·3 at sunny Seville, but 6·1 at Bilbao and 6·6 (misprinted 6·7) at Oviedo, the latter being almost the same as the average for London, according to Mr. Glaisher. The monthly amounts are :—

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
London ...	7·7	7·4	6·6	6·1	6·1	6·1	6·9	6·5	5·9	6·9	7·2	7·4	... 6·7
Oviedo ...	6·6	5·7	7·0	6·2	6·0	7·0	6·5	6·8	6·1	7·0	6·0	6·8	... 6·6

Hence we see that the winter is slightly more cloudy in London, and the summer more cloudy at Oviedo. The most striking contrast with English weather is the large number of cloudless days—days with *unbedecktem Himmel*—of which Oviedo, thanks to its proximity to the mountains, had only 50, while Saragossa on the average of eight years had 199, and Valencia 260, of which an average of 53 occur in June and July. By the bye, can anyone state how many cloudless days occur annually in any spot in the British Isles? The hygro-metrical tables are of at least equal interest, and besides the tables Dr. Hellmann's remarks are well worthy of attention. We regret that we cannot afford more space for noticing this able and interesting memoir.

THE *ATHENÆUM* UPON METEOROLOGY.

BURNS sang—

“ Oh ! wad some power the giftie gie us,
To see oursels as others see us,
It wad frae mony a blunder free us.”

And we are always glad to hear the opinions of lookers-on respecting Meteorological progress—or the reverse. The *Athenæum* of March 9th prints in its largest type a long article upon Meteorology, the most important parts of which we now place before our readers without a word of comment. Perhaps some of our correspondents may favour us with their views upon it next month.

“ Notwithstanding the rapid extension of meteorological and magnetic observatories over the globe, and the consequent increase of the number of observers, we are—after a most careful study of all the published reports, and of the numerous papers which have been published of late years—driven to the conclusion that meteorology still remains a science of observation. An enormous, an almost overwhelming, number of meteorological tables have been published ; but we do not find that any important deductions have been made from these recorded observations. When Luke Howard, some seventy years since, published his researches on the climate of London, he was enabled to show that the atmospheric changes moved in cycles of about nine and eighteen years. When Sir William Herschel directed his attention to solar spots in 1800, he was sufficiently daring to indicate a relation between the number of these black spots and the prices of corn in the market. Years passed away, and, eventually, nearly all the meteorological returns, which had been obtained at great cost, by several of the Governments of Europe, were submitted for reduction to Prof. Dove, of

Berlin, who carefully worked out a result, which very nearly corresponded with the hypotheses of both Howard and Herschel.

"If we examine into what has been done since that time, we shall find that—if we except the development of the law of storms—it amounts to little more than a verification of the conclusions of the elder philosophers. It would appear that we have cultivated most zealously the powers of observation, and that we have produced a large, well-trained band of observers; but there has been no corresponding development of the reflective powers; we have not produced even a small band of meteorological philosophers. Exception will probably be taken to this by many of the members of meteorological societies. Those who are disposed to deny our assertion that, for the amount of induction exhibited, there is not a corresponding amount of deduction shown, will probably point to certain papers in the *Transactions* of the societies, and reports of committees as evidence against us. We have not made our remarks until we have diligently and thoughtfully sought for evidence; and we feel strong in our position. We feel some satisfaction in being supported in this view by the President of the Royal Society, who, in his Annual Address, expressed his hope that the means placed at the disposal of the Meteorological Committee may serve to establish meteorology on a scientific basis. The means for obtaining correct records of atmospherical phenomena are certainly considerably improved. We find in the last published Catalogue of the ill-starred Loan Exhibition of Scientific Apparatus a list of barometers, thermometers, rain-gauges, anemometers, hygrometers, ozonometers, and other instruments, which number nearly 200; and in other sections of the catalogue are numerous instruments which bear directly upon meteorological research. These instruments in their construction show a considerable amount of thought, and are admirable in many respects for their great delicacy and their striking ingenuity. The arrangements made by the committees of the meteorological departments of the several Governments of Europe and America, aided as they have been by the electric telegraphs, and especially the arrangements made by the permanent committee of the Vienna Congress, all tend to the production of an invaluable series of returns in relation to ocean meteorology and weather telegraphy. The reports which we have placed at the head of this article—and they might have been very largely increased—show how closely we have linked together those points upon our globe which are important in meteorological research. The results of those arrangements hitherto have been the distribution of storm-warnings, which are not yet so trustworthy as they may certainly be rendered; and, in connexion with ocean meteorology, some valuable charts have been produced, especially those which represent the phenomena that the sailor may expect to meet with in the region of the Doldrums. * * * *

"These are all evidences of the excellent work which is being carried out. What we contend for is that we may go on multiplying observatories and observers, that we may publish still more voluminous reports, and discuss in our societies and congresses questions connected with the isolated phenomena observed, yet that these will not lead us to a knowledge of the laws which regulate the motions of the great atmospheric envelope of our planet.

"The atmosphere, a mixture essentially of two dissimilar gases, possessing peculiar physical and some remarkable chemical properties, is held in connexion with the solid mass of the earth by the exercise of a mysterious force. This is liable to disturbances under the influences of solar radiations; hence the great tides indicated by our barometers. The changes are, some of them, due, no doubt, to heat, which we use our thermometers to discover, and by which the 'weather conditions' are produced. And beyond these are electrical changes, now made out to be, as we know the earth's magnetism is, dependent upon disturbances in the sun. Consequently we require the powerful industry of a gifted mind trained into the habit of broad generalization, who shall bring together, out of the vast accumulations of observations which we can now place in his hands, the established facts which they hold buried, and from them draw those philosophical deductions which are required to advance meteorology to be a science, but little inferior in exactness to astronomy, with which it is so closely allied."

RAINFALL REPORTS.

To the Editor of the Meteorological Magazine.

SIR,—An error having been found in my Table of Days, and some delay resulting therefrom, I impose on myself the penalty of 10s., which I now remit.

I think it would be a good practice if observers would fine themselves for delay or for error. If observers would make for themselves some such rule as this, to pay 2s. 6d. for every fortnight after the end of the year which elapses before sending the report, and 2s. 6d. for each correction that is needed, the money raised by such voluntary fines would probably considerably facilitate the speedy and correct compilation of tables, &c.—Yours respectfully,

JOSH. H. HILL

Hull, February 22nd.

[We can, of course, express no opinion upon this suggestion, but it appears to us that we can hardly do wrongly by printing the letter precisely as we have received it, and submitting it to the consideration of the observers.—ED.]

THE MOON'S INFLUENCE ON THE WEATHER.

To the Editor of the Meteorological Magazine.

SIR,—Some of us have been accustomed to hear from our infancy the old saying—

“Saturday moon and Sunday full
Never was good, and never wull.”

And those who, like myself, have had to do with rivers have been taught to expect high floods at those times and seasons.

The last moon having been one, has again called my attention to the subject, and for proof of correctness or the contrary of this old country proverb, I have looked back for fifteen years for facts, and find as follows:—

Year.	Month.	Rainfall. in.	Year.	Month.	Rainfall. in.
1863,	April	1·01	1871,	January	1·48
1864,	June	1·25	1874,	October	0·82
1865,	February	1·64	1875,	July	4·62!!
1869,	August	0·45	1876,	August	3·09!
1870,	April	0·61	1878,	February	0·94

The above are returns for the four weeks following the new moon, the average per month being 1·59 in., the general average of the last fourteen years being 1·90 in. per calendar month. It will be seen by this account these occurrences are very occasional, sometimes not happening for four years, and never more than once a year.

While on this subject I am reminded of a conversation I had with a friend on the convenient topic of the weather. After a long continued wet season, I said, we shall have fine weather soon, for the next change in the moon is near midnight, and his response was “I am no lunatic.”—I remain, dear Sir, yours cordially,

Cambridge.

JAS. NUTTER.

HIGH TEMPERATURE ON FEBRUARY 17TH.

To the Editor of the Meteorological Magazine.

SIR,—My max. thermometer having on Sunday last, the 17th inst., registered the highest shade temperature ($58^{\circ}3$) ever recorded by me in February, and subsequently hearing from Mr. W. F. Denning that his instrument gave a reading ($59^{\circ}6$) on the same day, beyond any previously taken at Bristol since 1853, it struck me that these few lines on the subject (if not forestalled by some more skilful writer), might interest your readers, as likely to elicit from them whether the unusual excess was general on the day in question; or, if only partial, over what portions of the country it extended. The moon, moreover, having been at its full on the 17th, and in perigee on the 18th, those who believe in lunar influence on our atmospheric changes may possibly derive comfort, in the present case, from the coincidence as corroborative of their views.—I am, Sir, yours truly,

F. BONNYCASTLE GRITTON, F.M.S.

Eglinton Villa, Holt, Trowbridge, Wilts, February 21st, 1878.

P.S. By reference to "Greenwich Extreme Temperatures," I find that the Bristol max. above quoted has not been exceeded since February, 1869.

THE EARTHQUAKE OF JANUARY 28TH.

WE have some further information respecting the above. In the first place we may state that M. Marié Davy has examined the curves of the various self-recording instruments at Montsouris, but has found no trace of the disturbance; considering the extremely compact and solid mounting of most of the instruments, this is perhaps not remarkable. At present there is no seismograph at that observatory. Indeed, to the best of our knowledge, there is not one anywhere in the north-west of Europe; the British Association were going to do something in the matter at Comrie, in Perthshire, and one would naturally suppose that M. Perrey, of Dijon, who is one of the greatest authorities upon earthquakes, would have started such an apparatus, but we believe, as we have said, that there is not one at work anywhere.

The *Bulletin International de l'Observatoire de Paris* for February 1st reports the shock to have been felt at many places in northern France, especially in the adjoining departments of Seine-Inférieure and Calvados, *e.g.*, Rouen, Havre, Caen, &c.; but it was also felt in the extreme south at Tarbes in the Hautes Pyrénées, and in the extreme east at Thionville in Alsace.

Our attention has been called to the following statement in the *Times* of March 5th:—

SUBMARINE VOLCANOES.

"*West Cowes, Isle of Wight, March 3.*—The master of the D. M'B. Park,

British bark, arrived here from Batavia, reports as follows :—‘Jan. 29, at 7 a.m., in lat. 4 20 N., long. 21 45 W., saw several submarine volcanoes throwing large columns of water about 100 ft. into the air, while the sea was in great commotion ; there was a very strong undercurrent. The weather at the time was very cloudy, with rain, and nearly calm. The sound was as of distant thunder.’”

The approximate contemporaneity is interesting, but as the above-mentioned time represents January 29th, 8h. 27m. a.m. Greenwich time, it is nearly twenty-four hours *after* the shock we have been discussing.

THE AMERICAN STORM WARNINGS.

In our January number we said (p. 183) that we should like to see an official report upon the recent efforts made by the *New York Herald*. Almost exactly that which we desired is furnished by an extremely able paper by Mr. R. H. Scott, F.R.S., in the *Nautical Magazine* for the present month. It is a long article, occupying nearly thirty pages ; but while we refer those specially interested in the subject to the original article for the detailed investigation, we select some parts of the general narrative, which will be interesting to every one :—

“The announcements of storms coming from America, which have occasionally appeared in the newspapers during the past year, have naturally attracted much attention on the part of the public. I, therefore, venture to submit to the readers of the *Nautical Magazine* the following notice of the outcome of a private enquiry which I have conducted into the results of these warnings, for the space of eleven months, ending with December, 1877.

“The idea that the storms of Western Europe were directly connected with West India hurricanes has long been entertained, and in 1853, Martin, in his ‘Memoir on the Equinoctial Storms of March–April, 1850’ (Harrison, Pall Mall), gave a chart of Atlantic Storm Tracks from the period in question. Dove, in his first edition of his *Gesetz der Stürme*, published in his *Klimatologische Beiträge*, part I., 1857, while contending that most European storms exhibit characters entirely different from those of Tropical Cyclones, argues that some of our disturbances originate in West India hurricanes, which, when they have recurved on entering the Temperate Zone, have continued their course in a north-easterly direction over the Atlantic ; but he says, ‘It is evident that the connection between a storm in the Temperate Zone, and the original Cyclone in the Torrid Zone, to which it owes its origin, need not necessarily be traceable, as a continuously advancing minimum, in the lower strata of the atmosphere.’

“This was pretty nearly the actual state of the question when Professor Daniel Draper, in his report of the Central Park Observatory of New York for 1872, stated that in his experience, out of eighty-six atmospherical disturbances expected to cross the Atlantic, only three seemed to have failed. This statement was quoted without further comment by Sir G. B. Airy in his Presidential address to the Royal Society in 1873, and thereby derived such additional weight that it seems advisable to examine it more in detail.

“The rule given by Professor Draper in his report for 1873 is as follows :—

“If a low barometer with an easterly wind be prevailing here, the mean travel of this wind per day for twenty-four hours before, and twenty-four hours after the time of the low barometer, is to be divided into 4,200 ; this will give the number of days that it would require for the storm to cross.’

“In analysing this statement we find two points on which some further explanation is required.

"Firstly, what is implied by the 'travel' of the wind?"

"The phrase is not usual in this country, but I presume from the context, that it means 'the distance travelled by the wind,' or in other words its velocity per twenty-four hours. In fact 'velocity' is used for 'travel' in the discussion of storm eight (Report for 1873). However, the existence of any proved connection between the velocity of the wind in a storm and the velocity of translation of the storm as a whole is not recognised by European meteorologists, and so we must only suppose that Mr. Draper applies the term 'travel' to this motion of translation of the entire disturbance.

"Secondly. Information is desirable as to the precise test applied to the disturbance at this side of the Atlantic. Mr. Draper speaks of 'storms.' This word, in our phraseology, would imply Force 9 of Beaufort's Scale, a strong gale, with a velocity of over fifty-five miles an hour. I can only remark that as a fact, during the period investigated, this velocity was not reached on nearly all of the eighty-three occasions cited at either of the two observatories, Valencia and Falmouth, the returns from which alone Mr. Draper consults as indications of British weather. In fact, if we take the period, February 1 to April 10, 1872, during which Mr. Draper counts eleven of his predictions to have been fulfilled, examination of our anemograms shows that on only two occasions was the velocity of fifty miles reached at either of the observatories cited by Mr. Draper, while that of fifty-five miles was not registered anywhere during the time in question.

"I shall, therefore, dismiss this subject with the remark that Mr. Draper was, to say the least, over sanguine in his statements.

"Coming now to actual attempts to transmit useful intelligence by telegraph across the Atlantic. The first practical proposal for such a service, as far as I am aware, was made to me in August, 1867, by Mr. John C. Deane, at that time Secretary to the Anglo-American Telegraph Company, and through his instrumentality a station was organized at Heart's Content in Newfoundland, and the first report arrived January 13th, 1868. We received the telegrams *gratis* for the space of nearly four years (up to November 1st, 1871) through the great liberality of the Anglo-American Telegraph Company, but we could not turn them to practical use, partly owing to the circumstance that the site of the station was chosen as a sheltered nook where no storm could possibly hurt the cable, so that the wind felt at the head of the bay, and reported to us, bore little relation to that blowing outside. This fact came prominently into notice at the time of the disappearance of the S. S. *City of Boston*, in February, 1870. More particularly, however, was it difficult to use these telegraphic reports, on account of the circumstance, that though storms may sometimes cross the Atlantic from shore to shore, they change their character *en route*; some increasing and others dying out, so that it is all but impossible to predict which storm, out of several starting from the States, will reach us. Professor Loomis, a very high authority on American weather, supports this view very strongly in the following words, taken from the *American Journal of Science and Art*, for January, 1876:—

"'When storms from the American continent enter upon the Atlantic Ocean they generally undergo important changes in a few days, and are frequently merged in other storms which appear to originate over the ocean, so that we can seldom identify a storm in its course entirely across the Atlantic.'

(To be continued.)

THE WEATHER IN FEBRUARY.

At the beginning of the month a large and deep barometric depression was shown in the north of Sweden. On the 2nd, readings were highest over Ireland, but were comparatively uniform over the whole of these Islands.

From the 3rd to the 9th the weather was very dull, gloomy and foggy, but dry and quiet. On the 4th the mercury fell in the extreme north, as well as in Norway, and a large depression had apparently advanced from the westward to the north of Scandinavia, while in the south pressure was increasing slowly. A large area of high readings (30.5 in.) lay over England and Ireland. The wind blew a hard gale from the westward at Christiansund, but at all other places it was light in force, from south and west in the W. and N., and from the north and east in the E. and S. Next day a fresh depression appeared in the south of Scandinavia, causing the mercury to fall quickly there, and to a less extent everywhere else with the exception of England, France, and the Netherlands. The area of high readings still lay in the above-mentioned position, but was extending. The weather continued very dry and the sky was clear.

From this day till the 8th the changes in the condition of the atmosphere were unimportant; but on this day a rapid fall of the mercury occurred over Lapland, and extended in a less degree all over Sweden, but in all other places the changes were inconsiderable. Gradients were rather steep over Scandinavia and north-westerly winds strong to a gale were reported there, but on our coasts the area of high pressure still remained, and light airs were experienced. By the evening pressure was decreasing on all our coasts, and the morning after it was found that the mercury was falling everywhere, except over Scandinavia.

On the 10th the pressure decreased over the whole of Western Europe, the change over Great Britain being rather brisk. Readings were highest (30.2 in.) over central France, lowest (29.6 in.) over Sweden, but a slight depression appeared to be lying over Ireland. On the following day the mercury was falling in the S. and rising in the N., so that a band of very uniform pressure existed over these islands and France. Within this band readings were a little above 29.9 in., and thence they decreased to 29.8 in. at Valencia, and to 29.6 in. in Sweden.

On the 12th pressure began to increase over all Western Europe; the change had, however, been much greater in the east than in the west, so that while a large area of high and uniform readings was shown over Great Britain and the North Sea, moderate gradients were formed on our western coasts.

From this time until the 17th the changes in the weather were few and unimportant. On the 17th and following days numerous depressions advanced to our neighbourhood, but though causing the barometer to oscillate considerably, they did not affect the wind to any great extent. From the 17th to the 21st the course of the disturbances was from south-west to north-east along our western coasts, and south-westerly winds with warm weather prevailed; but on the 21st a large anticyclone was formed in the south-west, which subsequently extended northwards over England, so that light westerly breezes with dry, but dull, weather was general. On the 22nd, temperature rose to an exceptional height over Scotland, the maxima at Aberdeen and Thurso being 59° and 58° respectively.

Atmospheric pressure for the remainder of the month was very unsteady, though no serious disturbance reached our shores. Readings were highest over France, while areas of low pressure travelled in a north-easterly direction along our north-western coasts, and passed on to Norway at the same time that small subsidiary depressions crossed these islands. Wind was consequently southerly to south-westerly generally, and though moderate or fresh in force on most days, increased to a slight gale on some occasions. Temperature at the end of the month was very high for the time of the year; it varied from 54° at Valencia and Biarritz to 39° at Aberdeen. Mist was very prevalent on the last days of February, and rain was general in Western Europe.

H. E. M.

FEBRUARY, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 41 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Deg.		Date.	Deg.	Date.	In shade	On grass.	
				Dpth	Date.								
		inches	inches.	in.									
I.	Camden Town	1.49	+	.27	.41	13	11	59.7	17	25.7	8	5	10
II.	Maidstone (Hunton Court)...	1.20	—	.02	.34	27	10	...	...	...	...	...	...
III.	Selborne (The Wakes).....	2.84	+	1.13	.73	12	18	53.0	17	24.5	1	7	12
III.	Hitchen	1.28	+	.02	.34	13	17	55.0	17	25.0	7	11	...
IV.	Banbury	1.61	+	.18	.41	13	15	57.0	17	23.0	8	12	...
IV.	Bury St. Edmunds (Culford)...	1.23	—	.19	.24	13	12	58.0	17	24.0	7, 8	9	13
V.	Norwich (Sprowston)	1.07	...	...	.26	12	12	...	...	...	...	...	...
V.	Bridport	2.30	+	.24	.54	28	9	...	...	...	...	...	...
"	Barnstaple	2.23	+	.15	.73	27	14	58.0	17	28.0	2	...	...
"	Bodmin	2.81	+	.02	.93	12	14	57.0	17	23.0	1	3	5
VI.	Cirencester	1.94	+	.33	.51	12	12	...	...	...	...	...	...
"	Shifnal (Haughton Hall)	1.23	+	.34	.37	12	12	55.0	17	24.0	1, 8	7	14
"	Tenbury (Orleton)	1.53	—	.04	.47	12	14	61.7	17	22.3	1	8	11
VII.	Leicester (Town Museum)	1.24	...	...	.34	12	13	59.2	17	25.5	1	5	14
"	Boston	1.36	+	.15	.32	14	13	58.0	17	26.0	9	5	...
"	Grimsby (Killingholme)	1.03	...	...	.29	14	10	57.0	17	29.0	1, 8, 9	6	...
"	Mansfield	1.35	...	...	.45	12	11	58.6	17	24.6	1	10	13
VIII.	Manchester (Ardwick).....	.81	—	1.03	.33	13	8	58.0	17	26.0	1	9	...
IX.	York .....	.98	—	.40	.78	15	5	57.0	1	26.0	9	...	...
"	Skipton (Arncliffe)	2.21	—	1.46	.48	28	12	...	...	...	...	...	...
X.	North Shields .....	.96	—	.57	.39	14	15	55.0	17	30.2	1	5	6
"	Borrowdale (Seathwaite).....	11.74	+	.36	3.32	28	12	...	...	...	...	...	...
XI.	Cardiff (Crockherbtown).....	3.07	...	...	.87	27	16	58.5	17	26.5	1	4	...
"	Haverfordwest	3.85	+	.99	.98	11	14	56.0	17	26.5	7	3	9
"	Aberdovey	1.66	...	...	.65	28	13	57.0	18*	27.0	1	3	...
"	Llandudno	1.13	—	.22	.40	28	11	63.4	17	29.3	1	3	...
XII.	Dumfries (Crichton Asylum)...	2.38	+	.05	.58	28	13	55.4	18	24.8	4	10	11
"	Hawick (Silverbut Hall)	1.40	...	...	.29	17	12	...	...	...	...	...	...
XIV.	Glasgow (Cessnock Park)	2.32	—	.55	...	...	...	...	...	...	...	...	...
XVI.	Mull (Quinish)	2.11	...	...	.52	28	15	...	...	...	...	...	...
"	Loch Leven .....	...	...	...	...	...	...	...	...	...	...	...	...
"	Tyndrum (Ewick)	5.80	...	...	...	...	...	...	...	...	...	...	...
"	Arbroath	1.26	—	.59	.40	14	10	55.0	22	28.0	2	5	...
XVII.	Braemar	1.13	—	.85	.38	14	9	54.2	22	23.2	2	8	20
"	Aberdeen .....	.73	...	...	.22	14	11	59.1	23	25.8	1	3	20
XVIII.	Gairloch	2.04	...	...	.33	7	28	...	...	...	...	...	...
"	Portree	4.75	—	5.48	.65	6	21	...	...	...	...	...	...
"	Inverness (Culloden) .....	...	...	...	...	...	...	...	...	...	...	...	...
XIX.	Dunrobin	1.39	—	1.13	.22	7	13	55.0	21	25.0	25	6	...
"	Sandwick	1.98	—	.50	.33	27	20	50.4	20	31.0	26	2	6
XX.	Caherciveen Darrynane Abbey	3.06	...	...	.55	28	20	...	...	...	...	...	...
"	Cork	3.38	...	...	.80	26	9	...	...	...	...	...	...
"	Waterford	3.04	+	1.01	1.06	13	14	56.0	21	26.5	1	4	...
"	Killaloe	2.63	—	.27	.84	12	13	57.0	27+	23.0	1	5	...
XXI.	Portarlington	2.11	+	.08	.73	12	20	55.0	27	26.0	1	7	...
"	Monkstown, Dublin	1.63	—	.01	1.02	12	9	58.0	17	21.0	1	6	...
XXII.	Galway .....	...	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Waringstown	1.81	...	...	.35	15	17	57.0	17	28.0	1	3	8
"	Edenfel (Omagh)	1.49	...	...	.31	28	18	54.0	17+	27.0	1	5	...
"	Ballyshannon	1.39	...	...	.24	12	11	...	...	...	...	...	...

* And 19, 25.

+ And 28.

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

METEOROLOGICAL NOTES ON FEBRUARY.

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

ENGLAND.

SELBORNE.—A mild, but very foggy and cloudy, month; prevailing wind N.W. the first half of the month, but on the 13th it changed suddenly to S.W., and continued from that quarter for the rest of the month.

BANBURY.—Very foggy during the first part of the month.

CULFORD.—A month of very mild weather for the season, the mean temp. being 42°·1, and vegetation is consequently in a very forward state. Polar winds prevailed during 7 days. Heavy fog on the 9th.

SPROWSTON.—Dry and very mild month, with no S, and only two or three slight frosts.

BODMIN.—So mild a winter has never before been known; average temp. of the month, 44°·9.

SHIFNAL.—Sharp frost on the 1st, then dull and misty with high bar. till the 12th (7th and 8th excepted), when 37 in. of R fell in the night; misty again till the 17th, when bar. stood at 55°, the rest of the month mild and pleasant, with occasional showers bringing on vegetation, which was till then backward in spite of the open winter. Snowdrops in flower on the 13th, crocus on the 24th.

BOSTON.—Mean temp. 1° above the average, weather being very mild at the end of the month.

GRIMSBY.—Very fine month, with high temp. and high bar; vegetation perilously forward, but the ground in better condition for farming operations than at this season last year. Crocus and snowdrop in flower on the 8th; hazel shedding pollen on the 24th; apricot in blossom on the last day of the month.

MANSFIELD.—Foggy and gloomy month.

NORTH SHIELDS.—Lunar halos on the 11th and 16th.

WALES.

ABERDOVEY.—The weather was, with the exception of a few fine, sunny days, generally foggy, calm and damp, with less R than the average. Mean temp. 44°·5.

LLANDUDNO.—Fine month on the whole, mean temp. rather more than 1° above the average, R just about the average; slight frost on three nights only.

SCOTLAND.

DUMFRIES.—First half of the month was dry and cold. There was a considerable snowstorm about the middle of the month, and the latter half of the month was wet and unsettled; bar. and mean temp. above the average; winds generally moderate, chiefly from W. and S.W. during the latter half of the month.

HAWICK.—High winds on 15th, 16th and 17th. Lark first heard on the 23rd. The month has been very mild and spring-like; gooseberry bushes and the fruit buds of apple and pear trees are threatening to expand, prematurely it is to be feared, for spring frosts may yet come and nip these tender buds and blossoms. Farm work is in a forward state.

BRAEMAR.—The finest February ever known in this district. Thrush heard on the 8th.

ABERDEEN.—The mildest February that is on record; remarkably dry and quiet.

PORTREE.—On the whole a fine month, generally mild; gales on the 17th, 20th and 28th; S on the 25th and 26th; frost from the 11th to 15th. Fruit bushes and garden shrubs in full bud; grass quite green; sheep and cattle healthy and thriving well on the pastures.

DUNROBIN.—Mostly mild and fine, with very little frost.

IRELAND.

DARBYNANE.—Fine and very mild month, winds generally light and variable; gales from S.W. on 16th, 17th, 19th, 27th and 28th. Rhododendrons in flower on 20th; first primroses on 24th.

KILLALOE.—An unusually fine month for the time of year ; some heavy E the close, and temp. very high, the max. being 57° and min. 49° on the last day Hawthorn coming into leaf.

WARINGSTOWN.—Mild, fine, and favourable for farming operations.

EDENFEL, OMAGH.—The rainfall less than that of any month since May, 1876, and the temp. on only five nights was at, or below, freezing. Southerly winds and balmy airs prevailed.

BALLYSHANNON.—The month has been unusually mild and spring-like ; not the slightest frost ; rainfall considerably less than the corresponding period in 1877 (4·30 in.)

SUPPLEMENTARY TABLE OF RAINFALL IN FEB., 1878.

[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	1·06	XI.	Solva	1·93
„	Littlehampton	2·34	„	Castle Malgwyn	1·71
„	Hailsham	2·13	„	Nantgwilt, Rhayader ..	3·18
„	St. Lawrence, I. of W....	2·18	„	Carno	2·11
„	Strathfield Turgiss	1·55	„	Rhug, Corwen	1·23
III.	Addington Manor	1·66	„	Port Madoc	1·85
„	Oxford	1·26	XII.	Carsphairn	4·10
„	Northampton	1·58	„	Melrose	1·50
„	Cambridge	1·13	XV.	Gruinart	2·05
IV.	Sheering	1·40	XVI.	Grandtully .....	...
„	Diss	1·24	XVII.	Tomintoul	·41
„	Swaffham	1·47	„	Keith	·43
V.	Alderbury, Salisbury ..	...	XVIII.	Dalwhinnie	2·30
„	Compton Bassett	1·68	„	Auchnasheen	5·08
„	Dartmoor	5·00	„	Springfield, Tain	·70
„	Teignmouth	2·35	„	Glenfinnan	7·49
„	Langtree, Torrington ..	2·60	XIX.	Watten	1·83
„	Cosgarne, St. Austell ...	2·37	XX.	Glenville, Fermoy	2·77
„	Taunton	1·38	„	Tralee	2·49
VI.	Bristol	1·72	„	Tipperary	2·23
„	Sansaw	·92	„	Newcastle W., Limerick	1·26
„	Cheadle	1·81	„	Kilrush	1·83
„	Bickenhill Vicarage	1·18	XXI.	Kilkenny	2·20
VII.	Coston, Melton Mowbray	1·75	„	Kilsallaghan .....	...
„	Bucknall	1·23	„	Twyford, Athlone	2·03
VIII.	Walton, Liverpool	1·62	„	Mullingar, Belvedere ...	2·02
„	Broughton-in-Furness ..	4·00	XXII.	Ballinasloe	1·77
IX.	Stanley, Wakefield	·82	„	Kylemore	4·83
„	Mickley, Ripon	1·43	„	Carrick on Shannon	1·47
„	Whitby	1·09	XXIII.	Rockcorry	2·03
X.	Gainford	1·29	„	Warrenpoint	2·31
„	Unthank	2·89	„	Newtownards	2·33
„	Shap	2·99	„	Bushmills	1·28
IX.	Llanfrecfa	4·72	„	Buncrana	1·34

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXLVII.]

APRIL, 1878.

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THE EURYDICE SQUALL.

To the Editor of the Meteorological Magazine.

SIR,—The disaster of the 24th March, 1878, will not soon be forgotten, for its memory lives in many aching hearts, but the Meteorological conditions which occasioned it are likely soon to pass out of mind unless examined and recorded with some care. I propose, in this letter, first, to describe shortly the more general weather conditions of the day; secondly, to investigate from the data at present in my hands, the course, extent, and velocity of the squall in which the Eurydice capsized; and, thirdly, to make some observations on those particulars in which the squall was of a remarkable or instructive character.

The 8 a.m. reports of the Meteorological Office showed a large shallow depression east of the Gulf of Bothnia; in Scandinavia pressure was very uniform; moderately steep gradients for N.W. winds ($\cdot 017$ in., per 15 nautical miles, from Valentia to Shields) existed across the British Isles. The isobars and currents were somewhat wavy, a shallow secondary, with rain, lying over the N.W. of France, and another very slight one, with snow showers and very low temperature, over the north of Scotland.

The 6 p.m. reports show a moderate increase of pressure to have taken place over the northern part of the North Sea. The lower isobars then bulged westward over the extreme north of England, forming a secondary depression over that district. A more important secondary then lay over the South-east of our islands. Its centre was at that hour close to Yarmouth; bar $29\cdot 39$; but the $29\cdot 50$ isobar lying N.W. to S.E. from Liverpool to London trends from the latter southwards to Paris, and thence to N.E. through Belgium. The gradient between Valentia and Liverpool had risen to $\cdot 024$ in., and a moderate N. gale was blowing in the Irish Channel. No distinct trace of the squall is shewn in these reports, for the disturbance had passed over England between the hours at which the observations were taken.

Very fine weather prevailed at 8 a.m. over nearly the whole of England. At many localities in Scotland and Ireland snow showers were then falling, but I am unable, from reports hitherto received, to

identify the Eurydice snow-squall either north of the Border or on the west of the Irish Channel.* It does not appear to have been noticed at Dumfries or even at Holyhead. This letter may lead observers in the N. and W., who may be willing to do so, to communicate data from which the earlier stages—and, possibly, the first formation of the squall—may be traced. At present I incline to the belief that it originated over the Northumberland and Cumberland hills. The earliest notices of the squall yet received are North Shields 9.35, and Stonyhurst and Liverpool 10 a.m.

The accompanying table gives the times at which the snow-storm commenced and terminated at the different stations from which I have received reports of its passage. I have appended a ? to the name of the station in the cases in which the identity of the squall is doubtful, and to the time when not assured of the exactness of the latter. An * signifies that the report was communicated through the Editor; † that it was obtained from, or by the permission of, the Meteorological Office; and ‡ that it was derived from a newspaper cutting. The direction of the wind, when reported, immediately before, and during, the squall is also given in the table, with a few remarks mentioning, when known, the time of greatest wind-force.

As regards the appearance of the storm-cloud, both in its approach and as viewed from the rear, the few observations which I have received are scarcely minute enough to convey a very distinct impression, for the cloud-observer is a *rara avis in terris*. The front edge as seen from Worcester striking the Malvern Hills is succinctly described by one spectator as “resembling a white wall.” Another, who viewed it from Headley Common, in Surrey, calls it “an enormous black cloud like a monster balloon.” Others speak simply of “gathering clouds.” Mr. Glyde, one of the best cloud-observers in England, informs us that at Torquay “large cumuli, topped with cirri, began to show themselves in N.N.W., and gradually spread over” the sky, the snow and squall commencing 30 minutes after this appearance. This was as nearly as possible what I noticed in Leicestershire. White fragmentary cumuli, under a very clear blue sky, had prevailed during the morning. The storm first showed itself in distant N.W. (stretching from W.S.W. to N.N.E.) as a bank of dense white cirro-stratus, with bold cumuli running up into its under surface. I predicted thunder and a squall (the first of which did not occur, while the second exceeded my expectations), about forty minutes before the storm came over, and I believe most weather-watchers who chanced to be on the look-out would have made a similar forecast, *at least in this part of the country*. The lines of cirrus gradually spread to the zenith, moving rather slowly from due N.W., their front edge being, as I reckoned it, about 20 miles in advance of the falling snow. As the

* Since the above was sent to press I have received from the Meteorological Office the intelligence that “in the West of Limerick the change occurred about 11.30.”

snow ceased, 70 minutes after it had begun, the nimbus cleared with a straight edge in W. by N. At 4 p.m. this edge could only be seen 20° above the horizon in E. by S., and this edge, composed of high cirriform cloud, moved at that hour, to my surprise, rapidly from S.S.W. over a N.N.W. under-current. Thus the position of the cloud-bank as seen approaching and retiring suggested the idea that the snow-storm was of greater width on the eastern than on the western side of this station.

This seems borne out by the greater duration of the snow-fall on the east coast of England than on the west, for in Northumberland the duration was 1 hour 55 minutes, and at Grimsby 4 hours, whereas at Hereford it is reported as 20 minutes, and at Ross and Malvern 45 minutes.

In its progress south-eastward this peculiarity of contour seems to have been maintained, for at Camden Town you report it as lasting about 90 minutes, and Mr. Mawley gives the same duration for Addiscombe, whereas at Hurst Castle the duration was 45 minutes, and at Torquay 40 minutes.

It appears, however, that the eastern portion of the snow-storm travelled with considerably less velocity than the part which passed over the Midland counties. This fact is graphically shown in the two accompanying charts.

A change of an important kind also occurred in the snow-storm during its transit. In the north of England, and as far as the Midlands, the snow began some time before the severer part of the squall. Thus, at Stonyhurst, the wind rose to 14 miles an hour at 10 a.m., and reached 30 miles an hour at 11 a.m.; whereas in the Metropolis, and in the south of England generally, strong gusts occurred with or even before the falling snow. In Leicestershire the wind rose slightly with the fall of the first snow-flakes, but the actual squall, which I should estimate at force 7, did not occur till 15 minutes later, and scarcely lasted 12 minutes. It is also noticeable that in the north the wind continued to blow rather strongly at and after the end of the snow-storm, *e.g.*, at Stonyhurst it blew 20 miles per hour one hour after the sky had cleared; but in the south the wind, at the conclusion of the snow-storm, subsided very quickly. This is clearly shown in the Beckley's anemograph at Addiscombe, and Mr. Mawley remarks that "at the same moment that it ceased snowing the wind dropped even more suddenly than it had risen an hour and a half before."

As regards the direction of the wind on the earth's surface, at most, if not all, of the inland stations the N.W. wind which had prevailed at the earlier hours backed to a point south of W. before the storm commenced, and veered suddenly northward (at most places to N.N.W., and at a few temporarily to N.N.E.) during the squall. At North Shields, which lay somewhat near the centre of the small secondary at 9.30 a.m., the change of wind was from W.N.W. to N.N.E. The change at Scarborough was also from W.N.W. to N. At Yarmouth, which experienced the centre of the small depression at

6 p.m., the wind changed at that hour from S.E. to N.W. Snow is reported at this station to have fallen from "daylight to dark." But at none of these stations on the east coast does the wind seem to have blown with much force, and nothing remarkable beyond the sudden veering seems to have been observed.

At some places in the south-eastern districts the wind is reported in the newspapers, probably somewhat hyperbolically, as blowing "from all quarters."

"Estimating the velocity with which the snow-storm progressed from the time when the snow began to fall at Stonyhurst and at Hurst Point lighthouse, we find this velocity to be 40 miles per hour. If, however, we reckon it from the time of the greatest force of what may be called the actual squall we get the velocity of $48\frac{1}{2}$ miles. It is perhaps scarcely needful to state that neither of these velocities necessarily represents the velocity of the movement of the air, or the wind occurring in the squall.

For the horological accuracy of the table I am not responsible, but assuming this to be in the main satisfactory, I have constructed from the table the two accompanying maps, showing approximately the areas covered by the snow-storm at 10 a.m. and 3 p.m. respectively, with the general directions of the surface-winds and upper-currents, the former shown by solid, and the latter by dotted arrows.

Thus advanced, as if bent on its tragic mission, this remarkable storm-cloud. About 9 a.m. it left the Northumberland hills covered with deep snow. Seven hours later it sent its icy blasts down the chimes of the Isle of Wight upon the hapless *Eurydice*, just returning, like her fabled namesake, to loving greetings,—"*jam luce sub ipsâ.*"

Shortly before 5 p.m. the snow-storm reached Crowborough Beacon. It swept over Brighton as "a hurricane of wind and blinding snow," and left our shores. The snow was falling at Cape Griznez at 6. What modifications the squall may have undergone in crossing the Channel, or whether it was actually felt on the French coast as a squall at all, I have not at present the means of determining. Mr. Vibert reports a squall, with soft hail, at St. Aubyn's, Jersey, at 5 p.m., and the succeeding night was squally there.

As already mentioned, this squall is not reported as having occurred at Holyhead, where "there was nothing exceptional in the weather," but "the wind blew a fresh gale, with snow squalls throughout the day, nothing that would call for remark, and not a heavy gale at any time." It seems also not to have occurred, or to have been so slight as to escape notice, at some of the Welsh stations. Mr. Walker mentions, however, an extensive hail-shower, "decidedly a squall," at St. Ann's Head, at 0.30 p.m.

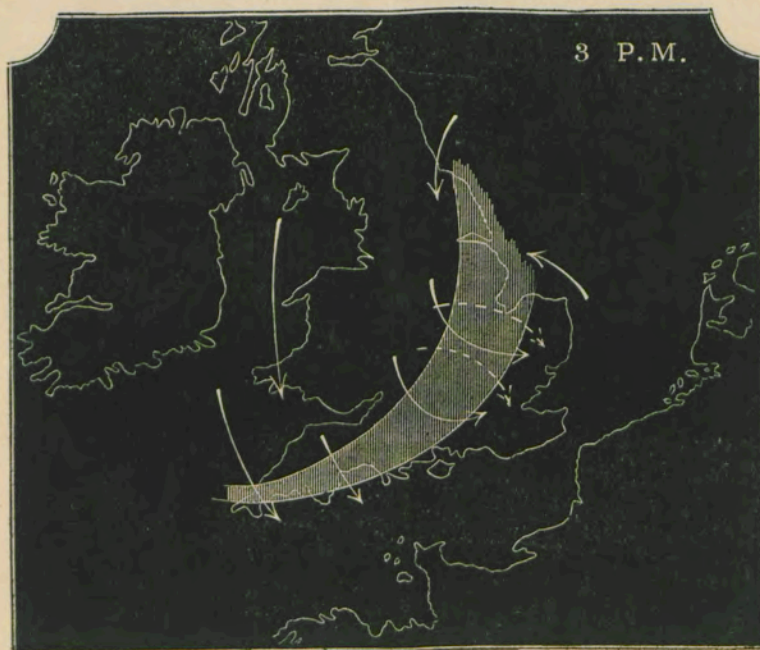
It is necessary to mention the subsidiary squalls which occurred during the day, especially between 4 and 6 p.m., in the N. and W. of the British Isles. A heavy thunder and snowstorm passed over Liverpool at 5 p.m. Lightning was seen at Stonyhurst, and also in the West Riding, about 8 p.m., and at that hour thunder and lightning

WIND, WEATHER, & CIRRUS, MARCH 24TH, 1878.

10 A.M.



3 P.M.



DETAILS OF PASSAGE OF EURYDICE SQUALL, MARCH 24TH, 1878.

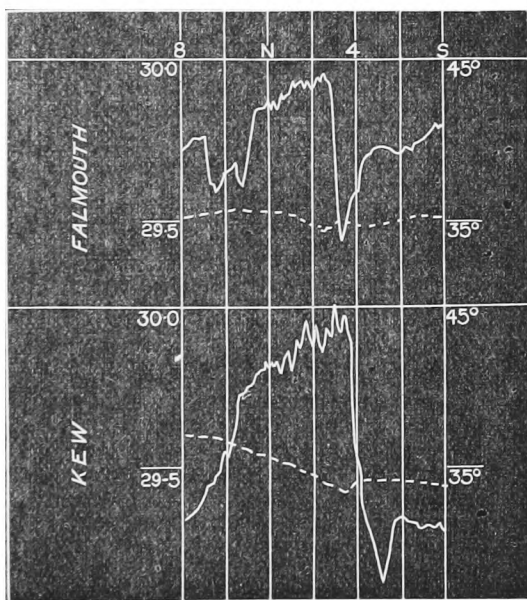
COUNTY.	STATION.	Snowstorm began.	Snowstorm ended.	Wind before snowstorm.	Wind in snowstorm.	REMARKS.	AUTHORITY.
Northumberland.	North Shields	9.35	11.30	WNW	NNE	Gentle to fresh breeze.	A. S. Nicholson.
Westmoreland.	Coppy Hill, Shap	11?	...	...	...	...	W. Hoggarth.
York	Aygarth, Bedale	10.20	...	SW	NW	Nimbus first in W., 10 a.m.	F. W. Stow, F.M.S.††
"	Arcliffe	10.15	0.0	...	...	Heavy snowfall.	W. Boyd.
"	Grassington Mines	10.15	1.30	W	NW	Hurricane at 11 a.m.	S. Eddy.
"	Skipton	11?	...	...	...	Gentle snow before squall.	"
Lancashire ..	Bridle, Chorley	10.25?	...	...	...	...	"
"	Stonyhurst	10	0.0	SW by S	NW	Velocity 30 miles, at 11 a.m.	S. J. Perry, F.R.S.
"	Liverpool	10	...	...	...	Severe snowstorm.	"
"	Manchester	10.40?	...	...	...	Snowstorm before noon.	"
Lincoln	Killingholme, Grimsby	1.30	5.30	...	...	Continuous snow.	J. Byron, F.M.S.
Shropshire ..	Shrewsbury	0.0?	...	...	...	Violent at noon.	E. V. Pigott, F.M.S.
"	Ludlow	11.55?	...	...	...	From N. towards S.E.	"
Stafford	Stafford	0.0	...	...	...	Snowstorm.	"
Leicester	Melton Mowbray	1.30	...	WSW	NNW	Snow with squalls.	A. M. Rendell.
"	Interworth	1.50	3	...	NNW	Hardest at 2.5 p.m.	W. C. Ley, F.M.S.
"	Hereford	1	1.20?	...	NW	Hailstorm, strong squalls.	E. J. Isbell.
"	King's Capel, Ross	1?	1.20?	...	NW	Squall, hail and snow.	A. Ley.
"	Ross	1	1.45	WNW	N	Violent for short time.	H. Southall, F.M.S.
Worcester	Tedstone de la Mere	0.40?	1.30	...	NNW	Violent.	F. S. Lea.
"	Malvern	1	1.45	...	NW	Travelled 35 miles per hour.	"
Northampton.	Northampton	2	3	...	...	Heavy.	H. Terry.
Cambridge ..	Cambridge	3.15?	...	...	...	Heavy squall 3.30 p.m.	G. Warren.
Norfolk	Diss	4.10	...	W?	W?	Very short squall from W.	T. E. Amyott.
Pembroke	St. Ann's Head ?	12.25?	...	N	N	Hail squall.	J. C. Walker.
Gloucester ..	Cheltenham	2	...	NW	N	Terrific, but short.	R. Tyler, F.M.S.
Berks	Newbury	2.30	3.30	...	N	Hurricane for short time.	J. Ward.
"	Windsor	3.5?	...	...	...	Snowstorm, and violent gusts..	"
Oxford	Oxford	2.15	3	...	...	Gusts before snow.	G. J. Symons, F.M.S.
Middlesex.	Camden Town	3.45	5.10	W	NW	Complicated currents.	"
Surrey	Kew	3.50	...	W by S	NW	26 miles between 4 and 5.15.	E. Mawley, F.M.S.
"	Addiscombe	4.5	5.30	...	...	Tornado, followed by snow.	"
"	Dorking	4.15?	...	WSW	NNW	Sudden, violent and short.	"
"	Greenwich	3.55	...	...	...	Slight fall of snow.	E. Baseley.
"	Tunbridge Wells	4.50?	...	...	...	Wind and snow at 4 p.m.	W. Merrifield.
Cornwall	Falmouth	2.45	...	...	...	Squall of wind.	G. W. Ormerod, F.M.S.
Devon	Torington	2?	...	...	...	Squall (force 6) for 10 min.	E. E. Glyde, F.M.S.
"	Tavistock ?	4?	...	...	...	Hurricane, sleet and rain.	"
"	Teignmouth	3?	...	...	...	...	J. Allen.
"	Torquay	2.45	...	...	...	Wind very high.	"
Somerset	Porlock	1.30	3.25	NW	NNW	Heavy sleet and snow.	T. Lanceley.
Wilts	Compton Bassett, Calne ?	4.30?	2	...	...	Terrific for 15 or 20 min.	"
"	Salisbury	3	...	...	...	Sudden snow squall.	"
Hants	Southampton	3	4	...	...	Short squalls, soft hail.	"
"	Hurst Lighthouse	3.15	...	...	...	...	"
Isle of Wight.	Ventnor	3.40	...	...	...	...	"
Isle of Jersey ..	St. Aubin's	5	...	...	N	...	J. E. Vibert, M.C.P.

occurred at Llandudno. At an earlier hour snow-showers are reported from S. Wales, Monmouth and Herefordshire. At Valentia a tremendous hail-squall occurred at 8 p.m., and one at Pembroke, force 9, at 1.30 a.m. of the 25th.

As regards the conduct of the barometers in the Eurydice squall, I have but few data, but these are of great interest. At Stonyhurst, the general decline, which took place until 5 p.m., was interrupted at the time when the squall reached its climax; pressure rising .028 between 11 a.m. and noon. At Babbacombe, Torquay, a somewhat similar rise occurred, .009 in ten minutes. At Falmouth, a well-marked jump, preceded by minor oscillations, is shown in the barogram at 2.45 p.m. Finally, at Kew the barogram shows a rather larger and smoother rise of pressure at the time of the passage of the squall.

The thermometers at all the places traversed, from which I have records, fell with extreme rapidity during the squall. At Bedale the fall amounted to $13^{\circ}\cdot7$; at Stonyhurst to $7^{\circ}\cdot4$; at Falmouth to 10° ; at Torquay to $10^{\circ}\cdot9$; and at Kew to $13^{\circ}\cdot9$; but the the fall at the last-mentioned station was more gradual. At the Royal Observatory, Greenwich, the fall also amounted to about 13° .

The diagram shows the barometric and thermometric oscillations at Falmouth and Kew, obtained from the Meteorological Office.



Mr. Cullum informs me that at Valentia Observatory the photographs showed "decided jumps" of the mercury "at the time of the squalls," which occurred frequently throughout the day, and that

these jumps "coincided with the dips in the thermogram, caused by the fall of hail."

How far the Eurydice squall was of an exceptional character it is difficult to decide, for the simple reason that we, at present, know very little either of the causes or of the morphology of squalls in general. I speak of *squalls* as distinguished from ordinary *storms* on the one hand, and from the very local *gusts* common in thunder-storms on the other. I have observed that squalls, in this restricted sense, commonly originate, in our latitudes, somewhat on the rear, but almost always on the right-hand half, of a cyclonic circulation. In this respect they resemble our ordinary secondary depressions, and with the latter they appear to be sometimes united, although the majority of our secondaries are not attended by squalls. The few squalls that I have attempted to examine have had much their longest diameter nearly at right angles to the direction of the wind, or of the isobars. In these respects the squall of March 24th may perhaps be regarded as typical. I believe, however, though I can scarcely prove, that the longest diameter of this squall exceeded the shortest, at least in the South of England, to an unusual degree. In one other respect it was decidedly exceptional, viz., in the backing of the cirrus current about 112° during its passage. Its influence upon the upper-current was in fact much the same as that which is produced by the transit of a large cyclone, and vastly in excess of that which usually occurs in the passage of small secondary depressions. This seems to indicate that this squall was of extraordinary altitude, the vertical movements of the atmosphere which attended it being unusually extensive.

It seems clear that the disturbance was associated with, and at its eastern extremity attached to, the secondary depression which passed south-eastward down our east coast; and it may be worthy of note that the subsidiary squalls, which occurred at a later hour in the west, stood nearly in the same relation to the other but less important secondary noticed at 6 p.m., over the north of England.

I have trespassed already so much on your space, that I must only suggest for the consideration of your readers two—perhaps they are really one—of the numerous theoretical questions that occur to me. Whence comes it that in a squall like this the velocity of the wind is much in excess of that corresponding to the barometric gradient at the time of the squall's passage, whereas before and after the squall, the velocity is low in relation to the gradient? And how is it that the wind-curves around and in the squall are what we should expect if the barometers were lower beneath the squall-cloud than on the outside of it, whereas they are actually higher?

One practical remark. It is obvious (apart from the fact that storm-warnings would not have saved the *Eurydice*), that the data received by the Meteorological Office could have furnished no forecast of this squall, and that that office would not from those data have been justified in sending storm-warnings to our South Coast. Whether far more frequent telegrams from a far larger number of observers, and at

a much larger Governmental outlay, may one day furnish the means of foretelling the course of a squall successfully, is a question on which I shall not enter. At present I know of but one practical lesson to be learned from the disaster of March 24th, which is this : Let meteorology, and, not least of all, the principles of cloud observation, occupy a very large place in the education of seamen.

With gratitude to the observers who have contributed the materials for this sketch, and last, but not least, to the Editor of the *Meteorological Magazine*.—I remain, yours truly,

W. CLEMENT LEY.

Ashby Parva, Lutterworth, April 10th, 1878.

[We were favoured by several correspondents with notes upon this squall, but hearing that Mr. Ley was willing to investigate the subject, we placed all the materials in his hands, and are sure that both the writers of the letters, and our readers, will agree with us in thinking that the arrangement has been in every respect most advantageous.—*Ed.*]

CANADA METEOROLOGICAL OFFICE REPORT.

To the Editor of the Meteorological Magazine.

SIR,—In your review of the Sixth Annual Report of the Meteorological Service for the Dominion of Canada, you quote the following :—“In many cases systematic errors have been committed, which were detected on the station being inspected, and their occurrence prevented for the future, but which have in several instances made the past observations entirely useless, and in others seriously impaired their value,” and add, “we cannot understand anyone printing such a statement as this, and not saying *which* past observations are entirely useless.”

It might, perhaps, have been better to have added in the Report that the observations referred to have, in consequence, not been published.

The omission was owing to the fact that the sole object of the sentence was to urge upon the Minister the necessity of providing means for more frequent inspection.

I trust that you will be good enough to insert this explanation in your Magazine.

I am, Sir, your obedient servant,

CHARLES CARPMAEL,

*Meteorological Office,
Toronto, Canada.*

Deputy Superintendent.

[We insert the above letter with great pleasure, as we always regret giving currency to a wrong impression ; but are sorry that Mr. Carpmael did not make his letter longer, for we are still far from sure that we comprehend the exact *status quo*. Certain stations have been

started, and subsequently, on inspection, errors have been detected which have vitiated the observations made prior to the inspection. We now learn that, for that reason, the records from those stations have not been published. Hence, we suppose, the fact is that these stations were all new ones, of which no records have ever been printed. We are very sorry that the Canadian office should find such difficulty in obtaining funds for the very necessary duty of inspection, as is implied in the last sentence but one of Mr. Carpmael's letter. When will people learn to estimate meteorological work by quality instead of quantity, and to treat able meteorologists as benefactors instead of beggars ?—*Ed.*]

SUPPLEMENTARY TABLE OF RAINFALL IN MARCH, 1878.

[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	1·87	XI.	Solva	1·67
„	Littlehampton	1·59	„	Castle Malgwyn	1·83
„	Hailsham	1·22	„	Nantgwilt, Rhayader ...	3·41
„	St. Lawrence, I. of W....	2·26	„	Carno	3·68
„	Strathfield Turgiss	1·10	„	Rhug, Corwen	2·82
III.	Addington Manor	1·06	„	Port Madoc	3·19
„	Oxford	·85	XII.	Carsphairn	2·30
„	Northampton	·63	„	Melrose	1·00
„	Cambridge.....	·95	XV.	Gruinart	2·26
IV.	Sheering	·97	XVI.	Grandtully .....	...
„	Diss	1·89	XVII.	Tomintoul... ..	2·62
„	Swaffham	·84	„	Keith	1·93
V.	Alderbury, Salisbury ...	1·31	XVIII.	Dalwhinnie	6·85
„	Compton Bassett	1·83	„	Auchnasheen	9·50
„	Dartmoor	4·17	„	Springfield, Tain .....	...
„	Teignmouth	1·81	„	Glenfinnan	11·21
„	Langtree, Torrington ..	2·74	XIX.	Watten	2·82
„	Cosgarne, St. Austell ...	2·36	XX.	Glenville, Fermoy	1·25
„	Taunton.....	1·50	„	Tralee.....	1·80
VI.	Bristol	2·19	„	Tipperary .....	...
„	Sansaw	1·35	„	Newcastle W., Limerick	1·40
„	Cheadle	1·20	„	Kilrush	1·21
„	Bickenhill Vicarage.....	1·16	XXI.	Kilkenny	·77
VII.	Coston, Melton Mowbray	·60	„	Kilsallaghan	1·57
„	Bucknall	1·12	„	Twyford, Athlone	1·92
VIII.	Walton, Liverpool	1·49	„	Belvedere, Mullingar ..	...
„	Broughton-in-Furness ..	2·75	XXII.	Ballinasloe.....	1·60
IX.	Stanley, Wakefield	·62	„	Kylemore	4·68
„	Mickley, Ripon	·70	„	Carrick on Shannon.....	2·36
„	Whitby .....	...	XXIII.	Rockcorry	1·67
X.	Gainford	·61	„	Warrenpoint	1·16
„	Unthank Hall	1·94	„	Newtownards	1·10
„	Shap	2·16	„	Bushmills	2·38
IX.	Llanfrechfa	2·25	„	Buncrana	3·01

THE LATE RAINFALL.

To the Editor of the TIMES.

SIR,—The accompanying table will show that only four times in 20 years has more than an inch and a-half of rain fallen at this station in 24 hours, and that during that period there is no instance of a fall of two inches in 24 hours.

These facts will render evident the extraordinary features of the rain of Wednesday night, when nearly 2½ inches fell in 12 hours, and not only so but the fall continued until 1.30 p.m. to-day, up to which time 3¼ inches had fallen.

It is somewhat too soon to speak positively as to the whole of the features of this remarkable and for this locality unprecedented fall, but a few of the leading features may be mentioned. First, it has been rather local; all the reports which I have received from the upper part of the watershed of the Thames, Oxford, Cirencester, Marlborough, &c., show that the fall there has been under an inch, and personal inspection of the Thames Valley this afternoon has shown few large volumes of water running in. The self-recording evaporator at Strathfield Turgiss shows that the fall of rain began about 3 p.m. yesterday and ended at 5 a.m. this day, but as already indicated the total amount is small, only 0·67 in.

I am glad to be able to supply a list of the fall at nine stations in or near the metropolis, which probably shows the facts as well as, or better than, any comments could do. It is curious that the fall here has been a trifle heavier than at any other station, but among the North London stations the agreement is remarkable, and I must add creditable to the observers. It appears that the fall on the south side of the Thames was less than in the north, but I have not yet received all the returns from that district. —I am, Sir, your obedient Servant,

G. J. SYMONS.

62. Camden-square, N.W., April 11th.

HEAVY FALLS AT CAMDEN SQUARE.

In.			In.		
1858	·94	May 24.	1868	·93	May 29.
1859	1·66	Sept. 26, 1·01 June 12.	1869	1·03	November 27.
1860	1·10	May 12.	1870	·95	March 3.
1861	1·42	November 13.	1871	1·23	July 10th, 1·22 Sept. 29.
1862	·94	August 15.	1872	1·05	October 21.
1863	1·55	June 18, 1·02 June 5.	1873	1·04	October 12.
1864	1·01	November 23.	1874	·99	September 30.
1865	1·12	Jan. 26, 1·05 Oct. 22,	1875	1·29	July 14.
		1·01 August 23.	1876	1·61	December 23.
1866	1·33	June 30, 1·20 Jan 10.	1877	·88	November 11.
1867	1·82	July 25. 1·03 May 20.	1878	2·56	April 11.

DETAILS OF RAINFALL OVER THE LONDON DISTRICT, APRIL 10TH AND 11TH.

	Rainfall from 9 a.m. on 10th, to 9 p.m.	Rainfall from 9 p.m. on 10th, to 9 a.m. on 11th.	Rainfall from 9 a.m. on 11th, to 3 p.m.	Rainfall from 9 p.m. on 10th, to 3 p.m. on 11th.	Total Rainfall from 9 a.m. on 10th, to 3 p.m. on 11th.
	Inches.	Inches.	Inches.	Inches.	Inches.
London—Camden-sq. N.W.	·082 ...	2·475 ...	·675 ...	3·15 ...	3·232
„ —Highgate	— ...	2·65 ...	·56 ...	— ...	3·21
„ —235, Camden-rd., N.	— ...	*2·47 ...	·70 ...	3·17 ...	3·17
London—277, ditto	— ...	*2·54 ...	·63 ...	3·17 ...	3·17
„ —Royal Botanic Gardens	·09 ...	2·06 ...	·74 ...	2·80 ...	2·89
Muswell Hill	— ...	2·34 ...	·43 ...	2·77 ...	2·77
London—Hamilton-terrace, N.W.	— ...	*1·99 ...	·74 ...	— ...	2·73
London—Springfield-road, N.W.	— ...	— ...	— ...	— ...	2·69
Croydon—Addiscombe.....	*033 ...	1·579 ...	·588 ...	2·167 ...	2·200

* A small portion of this fell before 9 p.m. on the 10th.

METEOROLOGY OF MARLBOROUGH.

THE example set by Mr. Smith, by presenting to our readers copies of his paper on the rainfall of Hull, has not been set in vain. We have the pleasure of issuing with the present number a very interesting and useful meteorological history of the year 1877 at Marlborough, and a table of the rainfall as observed in that town from 1864 to 1877, both inclusive. We are not sure whether we and our readers are indebted to the Marlborough College Natural History Society or to its President, the Rev. T. A. Preston, for these valuable tables, but the two are so inseparable that it does not much matter. Need we point also to the great advantage of boys being early enlisted in such pursuits as those of which these tables are but one branch. There were no School Natural History Societies in our school-boy days, it was all Ovid, Virgil, and Homer.

THE AMERICAN STORM WARNINGS.

Continued from page 28.

"In February, 1877, Mr. J. G. Bennett, the well-known proprietor of the *New York Herald*, commenced sending occasional warnings to Europe, which have been published in the newspapers.

"The Meteorological Office, on the first appearance of these warnings, opened communications with the London Office of the *New York Herald*, and received a most ready response. Since that date we have received, almost without intermission, a copy of each storm-warning telegram which has been transmitted to this country from New York.

"I have instituted a careful comparison between these warnings and the weather subsequently experienced in these islands, and the main facts of this comparison are enumerated in the following tables, the headings to which explain themselves.

"The general result of the comparison is that during the entire period of nearly eleven months, thirty-six telegrams were received conveying warnings of forty different disturbances. . . .

"Classifying these warnings under four categories, viz., A, absolute success ; B, partial success ; C, very slight success ; D, absolute failure ; we find—

A	.....	7	.....	17·5
B	.....	10	.....	25·0
C	.....	6	.....	15·0
D	.....	17	.....	42·5
		<hr/>		<hr/>
		40		100·0

"These figures, therefore, show that not 45 per cent. of the warnings can be considered to be really successful. What is meant by 'really successful' is that the information conveyed by them was of real value to seamen in British ports.

"In conclusion, I can only say that while meteorologists are most deeply indebted to the generous public spirit of the proprietors of the *New York Herald* for their great liberality in transmitting these warnings gratuitously, the statistics given in the foregoing pages indicate that the results [estimates ?] of Mr. Daniel Draper are over sanguine, as regards the possibility of calculating the date of arrival of dangerous storms on our coasts, and that as yet the attempts to foretell weather by means of the Atlantic Cables have not met with a very marked measure of success.

"In the present state of our knowledge, we are of opinion that much more good would be done by publishing the facts on which the issue of the warning is from time to time based. It will be impossible to institute a thoroughly satisfactory testing of the warnings until we have before us a long series of synoptic charts of the winds and weather existing between America and Europe, similar to those now in process of publication for the month of August, 1873, by the Meteorological Office, samples of which may be seen in a paper by Captain Toynbee, on the Nova Scotia hurricane of the month in question, which appeared in the *Nautical Magazine* for December, 1877."

The paper concludes with a tabular analysis of the 36 warnings sent during 1877, which are so arranged that any reader can compare them with his own journal, and ascertain how far it corroborates the verdicts passed by Mr. Scott.

THE WEATHER IN MARCH.

There was a fall of the mercury over all Western Europe at the beginning of the month, the change varying from 0.3 in. in the N. of Scotland to about 0.02 in. at Paris. The highest readings (30.3 in.) lay in a narrow band over South France, the lowest (29.2 in.) were still shown to the northward of Scotland. This decrease continued all the next day over Scandinavia, N. Germany, and the southern parts of France, while over the British Islands the barometer had begun to rise. Temperature was very uniform over these Islands, and varied from 51° in London to 42° in the Hebrides. On the 3rd, pressure increased briskly in all parts of Western Europe, and the area of low readings which on the two days previous lay over the N. of Scandinavia, passed away over the Baltic. A large anti-cyclone lay over the Channel, the N.W. of France, and the Bay of Biscay. (L'Orient 30.51 in.) In the evening the barometer was still rising, except in the W., where it was steady, and the southerly wind rose to a strong breeze. On the 4th a depression lay near the Shetlands, and a second was approaching the W. coast of Scotland, while the area of high readings was still shown over the Channel and N.W. of France. The wind was easterly over the Bay of Biscay, south-westerly on all our coasts, and south-easterly at Skudesnæs; it reached the force of a gale at Valentia and Skudesnæs, but was moderate in most other places. Next day the barometer rose over England, Ireland, and the N.W. of France, but was decreasing everywhere else—rapidly over Norway and Sweden. This rise did not last through the day, and the next morning the barometer fell rapidly in the N., and to a less extent in all parts of Western Europe, except the S.W. of France and N. of Spain; a deep depression advanced to the neighbourhood of the Shetlands, suddenly, during the night, readings at its centre being about 29 in., while at Corunna the mercury was as high as 30.79 in.; very steep gradients were formed on our coasts. Wind was westerly over these Islands and France, but drew into S.W. on the eastern shores of the North Sea; it blew a fresh to a hard gale on our W., N. and N.E. coasts, and was strong and squally elsewhere. Temperature was high and very uniform, and the sky was clouded. The barometer began to rise the next day over the greater part of Ireland and England, but a fresh depression appeared in the N. of Scotland. This depression advanced south-eastwards, and had its centre at 8 a.m. over the Sound, where the barometer fell rapidly. Pressure again recovered over Scandinavia, and quickly on our E. coasts, and over the Netherlands, but in the W. the mercury fell briskly during the night, 8th–9th ult. A large area of high readings lay over France and threw out an arm northwards as far as Shields on the 9th, and in the evening it was reported that the barometer was falling briskly in the Hebrides, with a fresh south-westerly wind, while in all other parts of our Islands pressure was decreasing though more slowly. The 10th, 11th, 12th, and 13th partook largely of the character of their predecessors, though the con-

ditions were not so strongly marked. Readings were highest off our south-western coasts and over the Bay of Biscay, while depressions passed from N.W. to S.E. across Norway, Denmark, and Sweden, causing north-westerly winds strong to a gale on many parts of our coasts, with unsettled weather. By the 13th the last of these disturbances had disappeared over the Baltic, and pressure became high and uniform over these Islands, with light to moderate northerly breezes and fine weather, and from this time till the 24th a similar state of affairs prevailed.

Very little change occurred in the general distribution of pressure and winds until the 24th, when atmospheric pressure was increasing over Sweden and Norway, but decreasing over the whole of Western Europe, rather briskly in the north; readings were highest in the N. of Spain, but over these Islands and their immediate neighbourhood the distribution of pressure was very irregular; several small atmospherical disturbances being shewn. Wind was northerly to north-westerly, and though light or moderate in most places was strong and squally over Scotland and the Irish Sea. In the course of the day a small depression passed southward from the north of Scotland along our east coast, causing an extremely sudden change in the weather, bright, clear skies being followed very quickly by heavy snow, while the wind rose to a fresh or hard gale in the W. of Scotland and N.W. of England. In addition to this a very sudden and heavy north-westerly squall passed with great rapidity over England, the wind for a few minutes rising to the force of a fresh gale. This change occurred at 10.20 a.m. at Bedale, in Yorkshire, at 3.30 p.m. in London, and at about the same time in the Channel.

On the 25th the mercury fell somewhat over the Netherlands and East of France, but rose in all other places: a large area of low pressure, having two foci, one over the Skager Rack, the other near Brussels, lay over the North Sea, and the countries on its eastern shores. Snow and hail occurred over the greater part of this country. Later in the day the mercury began to rise, and continued to do so until the 27th, when a small depression appeared to have passed across Scotland during the night, and joined that which was lying over the Skager Rack on the 26th. The weather was unsettled, with snow showers in many parts of the country. In the evening the depression noticed above travelled eastwards, over the S. of Sweden, and a slight recovery commenced on our east coast, though elsewhere the barometer still fell. This decrease spread the next day over the whole of Western Europe, and two distinct areas of low readings were shown, one still in the neighbourhood of the Skager Rack (the Skaw 29.32 in.), the other over the Bay of Biscay (L'Orient 29.45 in.) Readings were very uniform, and the winds, which were light, were governed by the two cyclonic systems. During the day (28th) the southern disturbance became much deeper, and advancing slowly up the Channel, caused strong easterly winds in the S.E. and S. at 6 p.m. After that hour the wind rose quickly, and an exceptionally heavy easterly gale was felt all along our S. coast. Such a strong gale from the eastward has not been experienced in the Channel for a long time, and the snow which accompanied it was exceedingly heavy, more particularly in Devon and Cornwall.

Reports the next morning shewed that the bar. was rising in the N., while the northern depression was filling up, and had become of very little importance, the southern disturbance, on the contrary, which at this time lay over the Channel and N.W. of France, had become very much deeper (Brest, 28.92 in.), and caused steep gradients over England and Ireland. It was reported later in the day that the depression was moving away eastwards over N. Germany, while the wind had backed to the northward. At Shields it blew a hard gale at 7 p.m.

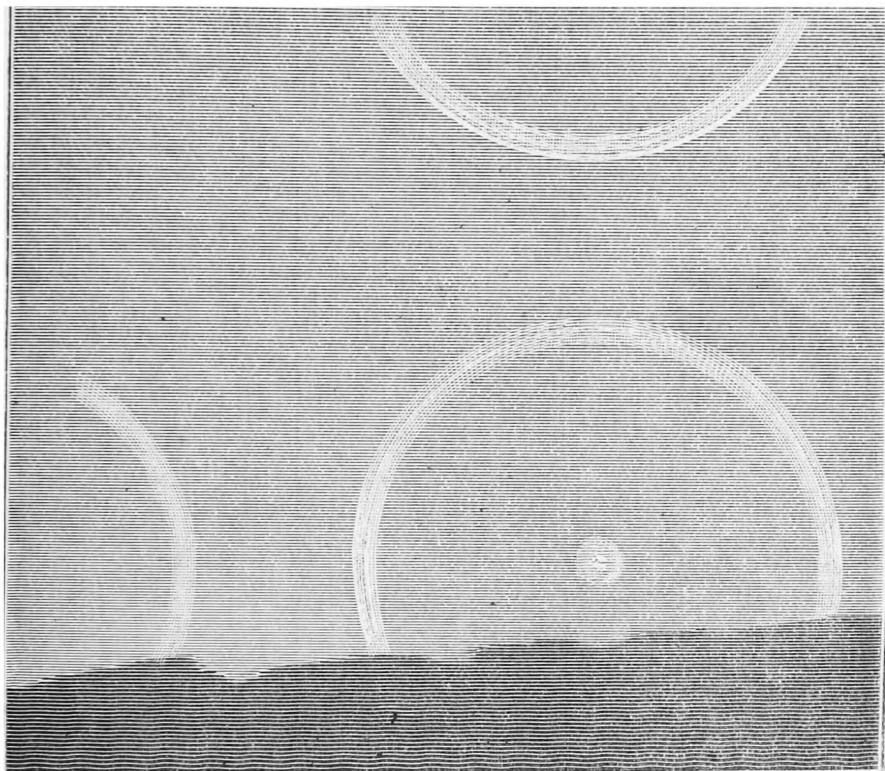
On the 30th the mercury fell quickly on the eastern shores of the North Sea, and the disturbance lay apparently over N. Germany and the Netherlands, but a brisk recovery began over the N.W. of France and the S.W. of England, but elsewhere very little change was reported. Wind was N.E. to E., except in Sweden. Temperature was rather higher in the W., but was lower elsewhere, several degrees over France; it varied from 39° to 31° over these Islands. The weather was unsettled with snow showers in several places, and the day passed without any change.

H. E. M.

SOLAR HALOS AND PARHELIA.

To the Editor of the Meteorological Magazine.

SIR,—This afternoon my sister had the good fortune to see a most interesting and beautiful solar halo—or, rather, system of halos—and parhelia. The phenomenon was first noticed about a quarter-past 4, and continued to get brighter till 4.20, and then gradually faded away, lasting altogether about 20 minutes. The accompanying sketch



will give some idea of the appearance it presented. The sky was tolerably clear at the zenith, but very hazy towards the horizon, where there was a thick bank of clouds; the halo round the sun, and the portion on the East, were merely hazy whiteness, with bright spots just tinged with pink and yellow where the parhelia would appear, but the upper inverted arc had all the prismatic colours (the purple being uppermost, or inside the arc), and appeared quite as bright as, if not brighter than, an ordinary rainbow.

This short account will perhaps be interesting for comparison with any other notes you may have on the occurrence.

I am, Sir, yours obediently,

E. WHITE WALLIS.

1, Springfield Road, St. John's Wood, March 14th, 1878.

MARCH, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which -01 or more fell.	TEMPERATURE.						No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.					
				Dpth	Date.		Deg.	Date.	Deg.	Date.	In shade	On grass		
		inches	inches.	in.										
I.	Camden Town	1.12	— .96	.50	28	10	58.0	3	26.4	17†	10	15		
II.	Maidstone (Hunton Court)...	2.01	— .15	.76	28	12	...	...	...	...	...	...
III.	Selborne (The Wakes).....	1.35	— 1.25	.69	28	6	54.5	21	21.0	17	10	14		
IV.	Hitchen	1.20	— .97	.41	31	10	57.0	1	23.0	31	16	...		
V.	Banbury .....	.67	— 1.53	.18	31	12	57.0	1	24.0	23	13	...	
VI.	Bury St. Edmunds (Culford)...	1.10	— 1.10	.23	29	12	59.0	1	15.0	31	16	16		
VII.	Norwich (Sprowston).....	1.17	...	.18	31	19	...	...	...	...	...	...
VIII.	Bridport	2.09	— .76	.49	28	11	...	...	...	...	...	...
IX.	Barnstaple.....	1.51	— 1.64	.37	9	11	58.0	4	29.0	27	...	...
X.	Bodmin	2.72	— 1.03	.52	29	16	57.0	9	23.0	17	3	9		
XI.	Cirencester	1.64	— .96	.65	1	9	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall) ...	1.12	— .82	.24	28	13	56.0	1	24.0	23†	11	12		
XIII.	Tenbury (Orleton) ...	1.13	— 1.29	.38	28	14	59.0	1	25.5	23	12	14		
XIV.	Leicester (Town Museum) ...	.69	...	.23	27	13	54.7	1	26.0	23	8	19	
XV.	Boston .....	.80	— .99	.40	24	8	58.0	1	25.0	23	11	...	
XVI.	Grimsby (Killingholme).....	.92	...	.29	24	11	57.0	6	28.0	23||	9	...	
XVII.	Mansfield .....	.49	...	.13	26	12	58.2	10	25.0	25	10	18	
XVIII.	Manchester (Ardwick).....	.88	— 1.56	.33	13	9	58.0	17	26.0	1	10	...		
XIX.	York .....	.96	— 1.03	.23	1, 8	8	57.0	1a	23.0	25	12	...	
XX.	Skipton (Arnccliffe)	3.85	— .96	1.52	1	14	...	...	...	...	...	...
XXI.	North Shields	1.17	— 1.18	.36	29	11	57.0	1, 18	26.4	23	12	12		
XXII.	Borrowdale (Seathwaite).....	8.06	— 5.34	1.47	5	12	...	...	...	...	...	...
XXIII.	Cardiff (Crockherbtown).....	1.25	...	.40	28	8	...	...	...	...	...	...
XXIV.	Haverfordwest	1.74	— 1.71	.37	28	15	58.0	2	27.0	13§	8	14		
XXV.	Aberdovey.....	1.28	...	.20	1, 17	15	62.0	21	28.0	23	7	...	
XXVI.	Llandudno.....	1.85	— .41	.59	1	15	55.2	21	31.4	14	2	...		
XXVII.	Dumfries (Crichton Asylum)...	1.07	— 1.53	.24	4, 9	8	55.3	19	24.0	23	17	18		
XXVIII.	Hawick (Silverbut Hall).....	.82	...	.17	4	9	...	...	...	...	...	...
XXIX.	Glasgow (Cessnock Park) ...	2.82	— .62	...	...	...	...	...	...	...	...	...
XXX.	Mull (Quinish)	2.90	...	.68	4	16	...	...	...	...	...	...
XXXI.	Loch Leven	1.00	— 1.82	.30	6	5	...	...	...	...	...	...
XXXII.	Tyndrum (Ewick) .....	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Arbroath .....	.80	— 1.24	.38	26	6	60.0	18	26.0	24¶	13	...	
XXXIV.	Braemar	1.85	— .36	.51	26	13	51.8	19	5.0	29	18	24		
XXXV.	Aberdeen	2.19	...	.34	26	17	56.1	18	23.9	28	12	21	
XXXVI.	Gairloch	3.31	...	.41	4	20	...	...	...	...	...	...
XXXVII.	Portree	5.91	— 3.13	.85	3	27	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	1.39	— .57	.47	31	19	55.0	20	22.9	29	12	17		
XXXIX.	Dunrobin	3.34	+ .72	.62	5	21	55.5	20	23.0	31	16	...		
XL.	Sandwich	4.03	+ .70	.51	5	24	50.9	4	25.3	24	11	17		
XLI.	Caheriveen Darrynane Abbey	1.83	...	.22	4, 24	19	...	...	...	...	...	...
XLII.	Cork	1.27	...	.50	1	8	...	...	...	...	...	...
XLIII.	Waterford	1.11	— 1.78	.65	2	9	57.0	18	30.0	15*	7	...		
XLIV.	Killaloe	1.98	— 2.34	.55	5	15	64.0	21	28.0	15††	12	...		
XLV.	Portarlinton	1.45	— 1.86	.33	23	27	57.0	2	28.0	15	11	...		
XLVI.	Monkstown, Dublin	1.22	— 1.36	.25	28	13	66.0	22	26.0	14††	10	...		
XLVII.	Galway	2.50	...	.89	2	19	60.0	19	30.0	16§§	6	...	
XLVIII.	Waringstown	1.88	...	.32	4	18	56.0	1	27.0	25	13	16	
XLIX.	Edenfel (Omagh)	1.64	...	.36	4	19	52.0	18*	27.0	13|||	14	...	
L.	Ballyshannon	1.80	...	.50	4	15	...	...	...	...	...	...

* And 21. † And 26. ‡ And 24. || And 24, 25, 26. § And 14. ¶ And 28, 29.

** And 23, 26. †† And 16, 23. ‡‡ And 15. §§ And 17. ||| And 27. α And 19, 23.

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

METEOROLOGICAL NOTES ON MARCH.

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.

HITCHEN.—A good deal of S towards the end of the month.

BANBURY.—High wind on the 1st and 6th; S almost every day from the 24th to the end of the month.

CULFORD.—This month has quite reversed the adage about "March coming in like a lion and going out like a lamb" the early part being distinguished by remarkably mild weather, while the latter part, and more particularly the last week, was of the most wintery character. It is rather remarkable that the max. temp. should have occurred on the first and the min. on the last day, the ther. falling to 15°, and in some parts of the neighbourhood I hear of greater cold being experienced. It is feared that the fruit crops are entirely destroyed. Mean temp. about the average (41°·2). High wind on 6th, 7th and 24th; H on 14th and 25th, and S almost every day from the 22nd.

HAUGHTON HALL.—March came in like a lamb, the 1st being the warmest day of the month (56°), with high bar. and S.W. wind. This pleasant, but deceitful, weather lasted till the 6th, when a strong gale set in from W., which lasted three days; from that time temp. gradually fell till night of 13th, when frost set in, continuing nightly with three exceptions (19th, 20th and 21st) till the close. S or sleet from 21st to 24th, which lay under the hedges till joined by more on 28th and 31st, causing April to come in clad in S with hard frost (25°). Apricot blossom all destroyed, and other damage done in garden.

ORLETON.—The first three weeks were dry with an average amount of sunshine, and warm with the exception of the period between the 13th and 17th, when there were frosts each morning. From the 22nd to the end of the month the weather was cold, with severe frosts and S showers almost every day. On 28th S fell nearly all day, and in the evening drifted much with a strong N.E. wind, blocking up many of the roads on the hills, and covering the whole country to a depth of 5 in. Bar. generally high; mean temp. about 1°·5 higher than the average; R less than half the average.

LEICESTER.—Lunar halo on 10th. S almost daily from 22nd to 27th.

BOSTON.—Beginning of the month mild, fine and open; the mean temp. of the month being 1° above the average. On the 23rd a cold period set in, the temp. for four nights in succession falling to 25°. Monday, the 29th, was one of the most bitterly cold days one may ever wish to encounter. A somewhat similar cold period with a snowstorm occurred in March, 1876, and also in April of the same year. Wind principally from N.W., blowing from that quarter for 20 days, or more than double the average.

GRIMSBY.—Up to the 22nd the weather was prematurely mild, afterwards it was proportionately severe. It has been a good seed-time for spring corn, and March dust has been abundant. The rainfall of the last three months only amounts to 4·03 in. Peach in blossom, and frogs spawning on 2nd, rooks building on 4th.

MANFIELD.—2nd, 3rd, and 4th beautiful spring days; 5th to 8th high wind. Cold winds with frequent S showers from 22nd to end of month, but bright at intervals.

ARNcliffe.—High wind on 5th and 6th; S on 24th, 30th, and 31st.

NORTH SHIELDS.—A good deal of S towards the end of the month.

WALES.

HAVERFORDWEST.—The general character of the month was mild, unattended by much wind, and very little R; with remarkably high pressure which began to give way on the 20th, when a bleak wintry period set in, with frost and S; prevailing winds N.W. to N. and N.E.

ABERDOVEY.—Generally cloudy, but comparatively dry. S and frost towards the end of the month; prevailing wind, N. to N.E.; from the 7th to the close, great and sudden variations in temp.

LLANDUDNO.—March went out like a lion, the last four days being both snowy and windy, but on the whole it was an unusually fine month; mean temp. more than 3° above the average.

SCOTLAND.

DUMFRIES.—Rainfall very small, and weather generally cold and stormy. S fell frequently in the latter half of the month, and during the same time frost was almost continuous in the morning and evening; the mean temp. is, however, quite as high as the average.

SILVERBUT HALL.—Strong westerly gales during the first week, middle of the month lamb-like, last week snowy, frosty, and very lion-like. Beautiful lunar halos on the nights of the 13th and 14th. A brilliant meteor at a little past 10 in the forenoon of the 26th, passed across the heavens from S. to N. at no great height; at the time the sky was clear and cloudless, and the sun was shining brightly.

QUINISH.—Mild genial weather until the 21st, when cold N. and N.E. winds, with S showers and frost at night, set in, and lasted till the 31st.

ARBROATH.—Last ten days of the month very cold and stormy.

BRAEMAR.—An excellent dry month up to the 21st, afterwards a heavy fall of S with intense frost. Oats sown on 15th, an unusual early date for this locality.

ABERDEEN.—A month of fine mild weather up to the 21st. From that time to the end of the month a severe snowstorm, S melting from day to day in town, but in the country lying in some places in very deep drifts.

PORTREE.—An unprecedented stormy month; 4th to 8th S.W. gales, and from N.E. on 29th. S from 21st to end of month, with severe frost and piercing cold wind. More S than has ever been known before at this season. Vegetation, and all other out-door labour completely stopped. The spring will now be late here.

DUNROBIN.—Up to the 20th, the weather was mostly fine and seasonable; from the 20th to the end, sharp frosts and heavy snowfalls prevailed.

SANDWICK.—February and March seem to have changed positions, February being unprecedentedly mild and March exceedingly cold, while the rainfall was much above the average. The first 11 or 12 days were wet, and sometimes stormy; then there was pleasant weather till the 21st, when S showers began and continued till the end of the month, with severe drift on the nights of 29th and 30th, which is unusual at this season.

IRELAND.

DARRYNANE ABBEY.—Mountains white with S on morning of 25th; slight S showers on 29th.

KILLALOE.—Mild open weather up to the 14th, with high temp. and good vegetation, followed by sharp frosts to end of month. S on 24th, succeeded by heavy gales from N. and N.W., with bright cold weather to end of month. A very favourable month for spring agricultural work.

MONKSTOWN.—The early part of the month was mild and showery; sharp frosts on the mornings of 14th and 15th; 21st exceedingly fine and warm; from that date to the end bitterly cold with strong N. winds, accompanied by S and H. A strong N.N.E. gale on 29th.

WARINGSTOWN.—Cold, but dry and favourable for sowing.

EDENFEL.—For the first three weeks there was a continuance of the fine and spring-like weather of February, but in the last 10 days there followed the only wintry weather we have had, with more or less daily S, and nightly frost, exactly reversing the proverbial character of March.

BALLYSHANNON.—The month was a very favourable one for spring work; the ground has been well dried, and the crops have therefore been got well in; the temp. has been low, and vegetation slight, the prevailing winds being polar. Slight falls of S and H from 21st to 24th, with a little frost on 28th.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CXLVIII.]

MAY, 1878.

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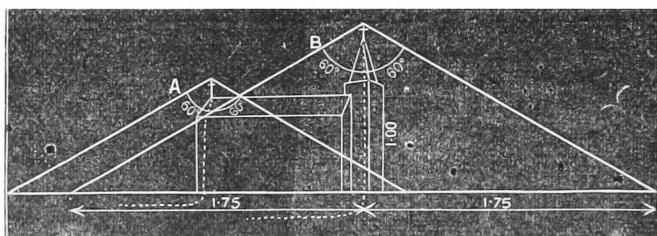
METEOROLOGY AT THE PARIS EXHIBITION.

POLITICS rarely affect Meteorology, though meteorological influences have great effects upon politics. We cannot help feeling that the disturbed state of Europe is the chief reason for the backwardness of the great Exhibition. Yes, truly great, far too great; why, there are reported to be twenty-seven miles of pathway, and we do not think that there is the slightest exaggeration in the statement. Backward it also undoubtedly is, and no portion so behindhand as the French; thanks to the Prince of Wales, England is fairly forward, but the Netherlands, China and Japan were ready first.

It is a great pity that the objects are (as they have been at all previous Exhibitions) grouped in *countries* and not in *classes*. Why not put all the locomotives together, all the furniture together, &c. ? There are perhaps ten locomotives exhibited, but one must walk a mile and a half to see them all, and that is hardly favourable to comparisons. Of course, what is true of one class of exhibits is equally true of all, and as we have very likely missed a few out of the twenty-seven miles, and, moreover, many cases are still empty, we certainly do not pretend to report upon all the meteorological apparatus exhibited, but we jot down, just as we discovered them, the exhibits belonging to meteorology, or sufficiently connected with it to claim notice in these pages. We must add that there are no catalogues of any use for us, and that when they are issued it will be very difficult to find individual exhibits, the classification, both in the Foreign and English Sections, being far from perfect. The gross value of the collection is enormous, but there are miles and miles of cases to pass which are neither more nor less than shop windows.

There are two exhibits of **Lightning Conductors**, one in the Telegraph Instrument Annexe to the French Department, the other in the British, viz., Newall's wire rope, both round and flat. M. Jarriant (58, Rue de Morny) is the French exhibitor, and one need hardly say more respecting his conductors than that they are highly approved by M. Francisque Michel, Secrétaire de la Commission des Paratonnerres. Their leading features are platinum points, brass shafts, then gal-

vanized iron for perhaps 8 feet, and thence downwards copper rope, buried at the lower extremity in a bricked trench filled with coke. With respect to the radius protected by a conductor, both M. F. Michel and M. Jarriant fix it at a cone whose base has a circumference whereof the radius is 1.75 times the elevation of the point. We think that this is a very obscure way of stating a very simple matter. Why not say that the area protected extends 60° on all sides below the point of the conductor, as, for instance, in the following sketch of a church :—



In this case the steeple is not high enough to bring the chancel end of the church within the cone protected by the conductor on the steeple, and, therefore, a second conductor is required at the other end of the church.

Some people are not handy at measuring angles. It may be well to explain how, without any cost and with little trouble, any person can ascertain whether any given portion of his house or church is efficiently protected according to the above rule.

Take a square card, not less than two inches square, put the letters A, B, C, D at the four corners so that A, B is at the top, B, C the right-hand side, and C, D the bottom. Cut across from A to C. Divide A to C into three equal spaces. Draw a strong pencil line from the lower of the two marks thus made to the corner B. Through B pass a needle carrying a thread with a rather heavy button at the end of it to act as a plumb-line; fasten the thread at B. Place the eye at A and look along the edge A B, while the thread is lying along the strong pencil line. If you can see the conductor above the edge B, the place whence you are looking is protected, if you cannot, it is not.

Electric Clocks are shown by several persons; we pronounce no judgment upon them because we are not horologists, but we are glad to see that wooden pendulum-rods are becoming nearly universal, and we welcome every effort to diffuse accurate knowledge of true time. There are a large number of Austrian $\frac{1}{2}$ second regulators, but there are few clocks of high quality, and Sir John Bennett is, as far as we have seen, the only exhibitor of full size marine chronometers.

Of **glass dividing** there is a small but extremely fine exhibit by Berthauld, of 30, Rue and Passage Dauphine, Paris. Of course, we cannot speak to the accuracy of his thermometers without testing them,

but the dividing and figuring is extremely good and so are all the subjects in his case ; in fact we have never seen better graduations.

A **Montsouris Thermometer Stand**, of which, through the courtesy of MM. Marie Davy and Gauthier-Villars, we give the engraving from the *Annuaire de l'Observatoire de Montsouris*, is exhibited by Baudin, and two cards hanging to it indicate that a Negretti Max., a Rutherford's Min., a dry and a wet thermometer are to be put upon it. Being inside the building it has no trees around it, and we are not sure whether the trees are, or are not, held to be desirable. We think that it would be better not to have them. Another stand of the same pattern is near the Montsouris Observatory.

The pocket **Compasses** may be splendid specimens of spoked wheels, but they are precisely what, in our opinion, compasses ought *not* to be ; except in a good light you cannot tell which is N. and which S.

Those who work much at **diagrams**, plotting curves, &c., may be glad to be referred to Bellavoine (142, Faubourg, St. Denis), who has a very large collection (200 or more) of copper plates, each divided differently, and sheets printed from them, even on best paper, are very cheap.

Among the Maps and Charts, we may mention the **Wind Charts** of M. Brault, published by the Dépôt des cartes et plans de la Marine at the serious cost of 1s. 6d. each.

With respect to Maps, we ought not to pass without favourable mention the extent to which the French employ relief or **raised maps** ; for teaching physical geography they are far better than the usual flat ones, and their increased use in the British Isles is certainly desirable.

It is rather curious how many subjects apparently unconnected with meteorology are really of importance to meteorologists. Here is an illustration. Towering above a café on one side and some machinery on the other, we found four telegraph poles, and attached to them notices stating that they had formed part of one of the Russian telegraph lines, had been prepared with common salt by a patent process in 1872, and dug up in 1878 for transmission to Paris. To all appearance the process of Baron de Hervarth (87, Pont Obouckoff, St. Petersburg) completely stops decay, but we wish that one had been laid down, sawn through vertically, and the line of the level to which it had been buried marked upon it. Now, for the application to meteorology : how about the legs of thermometer stands, how about anemometer poles, wind vanes, solar thermometer posts, &c. ? there is often an optician's heavy bill traceable to nothing but a half rotten post.

Near the Pont Iena, almost in the centre of the grounds on the South side of the Seine, is a square wooden house, the sides perhaps 8 ft. each in breadth and 10 in height, painted a quiet brown. This is entered on the plan as **Observatoire de Montsouris**, but the real Montsouris Observatory is quite another style of edifice, and this little erection contains only a few of the principal patterns of apparatus used at Montsouris. The apparatus is not yet adjusted, but most

things are in position—a Robinson's Anemometer (small size), which in order to enable the public to see it has been placed only 6 or 7 feet above the ground and quite under the shelter of the building. A rain gauge almost precisely the pattern of an 8 in. Negretti's gauge needs no comment. Then there is a curved sheet of glass, about 3 ft. by 3 ft., sloping down towards a receptacle to collect rain water for analysis. There is also a Montsouris thermometer stand (see *frontispiece*); but at present it has only carried a species of recording ozonoscope, called an Ozonograph, by the maker, Salleron. It is so arranged that different portions of the paper are exposed at different parts of the day. On the roof is a large circular vessel filled with earth, but exposed to wind and rain; this is an evaporator acting by weight alone, being attached to one end of a balance, the index of which traces a delicate line on a blackened sheet of paper, and thus a continuous record of its changes in weight is obtained. For temperature an arrangement is adopted which has some advantages, but we think some disadvantages also. The advantages consist chiefly in the ease whereby any temperature phenomenon can be recorded, and in the fact that half-a-dozen thermometers may be made to record upon a single cylinder. At the Exhibition a single drum takes the records of earth temperature, two solar radiation thermometers, a dry and a wet bulb one. The drawback is, that as the bulbs are virtually thin flat metal tubes, their capacity must vary with changes in atmospheric pressure, and therefore their zero points must be constantly shifting; but as they have an internal pressure of several atmospheres, the changes of an inch on either side of 29.6 can hardly be very serious. Moreover, the long narrow metal pipes which replace the column of an ordinary thermometer, must vary in capacity, not merely with external or internal temperature, or a mixture of both, but also according to the part of the building along which they pass. We are not satisfied that this correction can be accurately made.

(To be continued.)

EASTER AT THE SORBONNE, 1878.

SIEGES, revolutions and changes of many kinds have passed over Paris since the foundation of its University, and though the city is now passing through a crisis of excitement over the Exposition, no vibration of it reaches the Sorbonne. There the meetings and the paper-reading goes on just as usual, but perhaps there are a few more attendants than in previous years, since at the final meeting to hear the reports and receive the Minister (M. Bardoux), the large salon was crammed.

One serious blank could not but be realized by all, and was dwelt upon in all the general addresses—Le Verrier is no more; the *réunion* has lost its president, France has lost her foremost man of science, and the world one of its best astronomers.

The chief difference between the communications in the present and

in previous years, is the greatly increased number upon pure mathematics. With them, however, we have here nothing to do. But we shall probably be excused if (considering that probably no other report will be published in England) we devote half a-page to non-meteorological matters which we think may be of general interest.

Prof. Dieulafait, of Marseilles, reported the results of many analyses of fossil, ancient, and present, marine organic bodies, comparing the proportions of the rarer minerals which they contain, and thence drawing conclusions as to the constitution of sea-water in the past and present epochs.

M. Gosselet, of Lille, read a very interesting paper, illustrated by a good map, upon the changes which have taken place in the coast-line of the North of France since the time of the Cæsars; this he did by several separate methods—by an examination of the soil, by the antiquities dug up, by the names of the places, and by reference to the oldest chronicles.

M. Olivier, of Elbeuf, called attention to an improvement he has been making in telephones. The sounds given to a telephone are not reproduced at the other end of the same tone, or of equal intensity. M. Olivier thinks that this is because the vibrating material is a flat and uniform plate, and therefore it will only vibrate perfectly for its own proper tone. If it renders the fundamental and the first hyper-tones, it will vibrate but little, or not at all, for the sharper notes. It is quite otherwise with the tympanum of the human ear, which is concave, has no tone of its own, but being possessed of various tensions, can vibrate for every portion of the tonic scale from 60 to 40,000 vibrations per second. M. Olivier proposes to use diaphragms of varying thickness, so that while one part will vibrate for one tone, others will for others. In the subsequent discussion, M. Alluard, Director of the Observatories at Clermont-Ferrand and on the Puy-de-Dôme, said that the two establishments were united by a wire which was carried on the same post as another wire, but the two were at no point within a yard of each other, yet messages sent on either wire are heard on both.

M. l'Abbé Vassart, of Roubaix, made some remarks upon electrically synchronizing public clocks, which he believes is best effected by some arrangement by which an electro-magnet acts upon the escapement-wheel.—[We do not profess to understand the arrangement, but a specimen is said to be at the Paris Exhibition.]

M. Marchand, of Fécamp, reported upon the methods of analyzing milk now employed, and urged the adoption of one uniform method which would ensure correct results.

M. Doumet-Adanson, of Certe, in a very vigorous address, demonstrated his unfamiliarity with the more advanced branches of climatology. He seemed to assume that the only instruments employed are the dry and wet, max. and min. thermometers in the shade, and he contended, quite truly, that the range of these instruments was not equal to that of vegetation exposed to the full sunshine. He had

overcome the difficulty by placing on a post fully exposed, a thermometer, of which he had blackened the bulb with smoke ! How he was permitted to offer so crude a suggestion, or one showing such ignorance of what is being done, even in Paris itself, we cannot imagine. The real temperature of the exposed portions of a plant is very difficult to determine, because it depends on so many causes ; the one which alone suffices to upset any relation between M. Adanson's smoked thermometer and a cabbage-leaf is, that the plant is constantly evaporating, and the sap circulating ; what with these causes, and the difference of colour and texture, the contrast becomes sufficiently obvious ; of course the first shower of rain would wash off M. Adanson's smoke, and then his thermometer, acting as a spherical mirror, will scarcely be any warmer in the sun than in the shade. We do not think that anyone yet knows how to determine accurately the climatic experience of plants ; indeed, no two kinds of plant, and no two leaves of any one plant, are under precisely similar conditions. We know all about the heat and the moisture of the air itself ; we know the greatest daily heating power of the sun's rays, we ought to know also its total amount for each day, and M. Marie-Davy is just beginning to ascertain it. We know the lowest temperature of vegetation each night ; we know how much water falls upon it, and approximately, how much goes away as vapour. We know the temperature of the roots of plants at various depths, and M. Marie-Davy has made an attempt at determining the temperature of their leaves by painting thermometer bulbs green, and placing them over grass. For the reason we have already given, we do not believe that these thermometers tell much that is worth knowing, but they certainly excel M. Adanson's smoked ones.

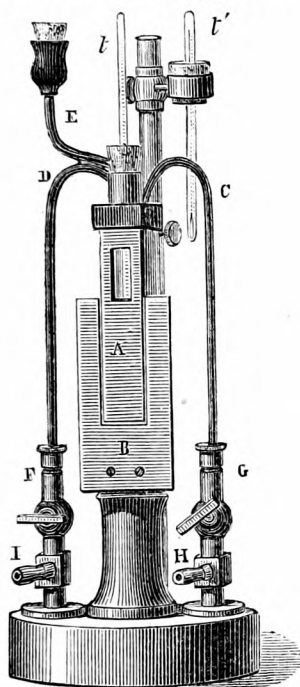
M. Hébert, Professor of Physics at Moulins, read a rather long memoir upon the great movements of the atmosphere. He has lately been studying closely the weather charts published three times each day by the United States Government, and considers that he has ascertained that the Atlantic storms have their origin in the Rocky Mountain district of Western America, being produced by the friction of the equatorial current against the mountain-tops. These tourbillons follow the river courses to the Gulf of St. Lawrence, and there form the great depressions which start across the Atlantic. M. Hébert said that they usually land in Europe on points situated between the mouth of the English Channel and the coast of Greenland,—[As Greenland is not usually considered to be part of Europe, we infer that M. Hébert means the latitude of Greenland]—re-descend usually across the Polar Sea to the North of Russia, across Siberia to the Sea of Ochotzk, and so to Alaska ; after passing over the extreme North of America, they again appear to touch Iceland, and finally fade away in the Arctic Regions. Under their influence, combined with that of the general Atlantic equatorial current, the numerous tourbillons are formed in the mountain ranges of Europe which cross the Mediterranean, the Black Sea, and the Bay of Biscay.

M. Hébert subsequently remarked that he had found traces of

similarly-produced effects in Southern Asia, and on the African continent.

M. Alluard, Dean of the Faculty of Sciences of Clermont, and Director of the Observatories at Clermont and on the Puy de Dôme, exhibited and described the new hygrometer which he has invented.

The hygrometer designed by M. Alluard may be best described as a much improved form of Regnault's. We had, however, better describe it thoroughly, as we are inclined to regard it as the best con-



densing hygrometer yet brought before the public. It is made by L. Golaz (24, Rue des Fossés-St-Jacques, Paris) of the following pattern. The essential features of the instrument are a square brass tube, gilt and highly polished, to contain ether (the evaporation of which by the passage of a current of air causes cooling and condensation of the vapour in the atmosphere upon its exterior) and a thermometer. This tube is marked A, and has two small windows which allow the ebullition of the ether to be seen. The thermometer *t* passes through the top of the square tube, and has its bulb in the middle of A, and is to be read at the instant at which dew is seen to be deposited upon the exterior of A. The air temperature is shown by the thermometer marked *t'*.

The little tube H G C passes inside A to near its bottom, the tube I F D only passes into the top of A. When an observation is to be made, ether is poured into the funnel E until it rises half-way up the window in the tube A. India-rubber tube is slipped on to the orifices H and I. By blowing into H the air is forced through the ether in A, cold is produced and dew is deposited upon the bright surface of A. Precisely the same effect is of course produced by attaching an aspirator to the tube I.

We now come to the two new features which distinguish this hygrometer from all others yet regularly sold, though each feature has, in some respects, been partly anticipated.

The first specific feature is the deposition of the dew upon a flat surface. M. Alluard is, we believe, the first to apply a flat surface to an ether-condensation hygrometer, though Mr. Dines has used it in his cold-water-hygrometer for years. There is no doubt as the great advantage of the change, the deposition is more easily seen than on a round surface, and is indeed visible at a distance of 8 or 10 feet.

Secondly, the face A is surrounded by a similar surface B, which is separated from it, and is not cooled. The comparison of the surfaces A and B renders it more easy to observe when A is dimmed, than

it would otherwise be. We believe that a duplicate round tube was used for this purpose with a Regnault's hygrometer at Kew, but with that exception the method is, we think, new.

Those who have often used Danielli's or Regnault's hygrometers are aware that the readings of the thermometer when the dew is first seen and when it disappears, rarely agree, and the mean is generally taken. The difference between these values may be regarded as the error of the instrument, and M. Alluard claims for his, that this difference is extremely small, rarely so much as $0^{\circ}\cdot 4$ F.

THUNDERSTORM ON MAY 1st.

To the Editor of the Meteorological Magazine.

SIR,—I enclose you the following particulars of the rainfall during the above storm. It appears to have been heaviest at or near Winchmore Hill. The following table of the rainfall between 9 a.m. on May 1st and 9 a.m. on May 2nd, will show the extent and severity of the storm better than any description I can give :—

Rainfall from 9 a.m. May 1st, to 9 a.m. May 2nd.

Station.	in.	Station.	in.
Enfield (Nag's Head Lane)	1·43	Deptford	0·44
Norwood	0·93	Eltham	0·41
Clapton	0·85	Greenwich	0·38
Tottenham	0·82	Blackheath	0·27
Southgate	0·77	Muswell Hill	0·17
Enfield Chase	0·70	Addiscombe	0·12
Lee	0·49	Charing Cross	0·07
Guildhall	0·45		

In some of the above instances the whole amount fell during the storm, and in others the greater part. The rain did not extend so far as this, and no rain fell during the storm at Bromley, Foots Cray, Surbiton, Regent's Park, Hampstead, Highgate, or Waltham Abbey. I do not know what the total fall was at Winchmore Hill, but at any rate 1·50 in. fell there between 5.15 and 5.50 p.m., an excessively large quantity to fall in 35 minutes, while the 0·93 in. which fell at Norwood came down between 6 and 7 p.m., or within the hour, when the gauge overflowed through temporary stoppage. The rain was accompanied by vigorous lightning and thunder at Tottenham, and the lightning was frequent and accompanied by remarkably heavy thunder at Clapton. The lightning was very vivid in the neighbourhood of Camden Road. The rain commenced at Southgate between 3 and 4 o'clock, and in most other places shortly after 5 o'clock, and ended between 8 and 10 p.m.—Yours faithfully.

W. P. SWAINSON.

277, Camden Road, London, N., May 6th, 1878.

SIR,—I send you a line to show you the rainfall I measured in gauge on Wednesday last, during the terrific thunderstorm.

The storm commenced at 4.38, and lasted till 7.44 p.m. During the first 38 minutes no less than 1·52 in. fell, and in the 3 hours and

22 minutes no less than 2·2 in. My gauge being well exposed, I think it worth my while to let you know. A good deal of damage was done to trees and greenhouses by the lightning and hailstones.

—Yours truly, JOHN W. PAULIN.

Vicar's Moor Lane, Winchmore Hill, 3rd May, 1878.

[We may add that at Hackney, Dr. Tripe recorded 1·31 inches.—*Ed.*]

THE EURYDICE SQUALL.

To the Editor of the Meteorological Magazine.

SIR,—I send you my report on the day of the remarkable squall :—

Date.	Sea Level Pressure.	Wind.	Force.	Direction of Cloud.	Temp.	Wet temp.
24th :—	in.				deg.	deg.
8 a.m.	29·610	E.S.E.	1	N.N.W.	32·0	31·0
0.45 p.m. ...	·476	W.	3	W.N.W.	42·3	37·7
4 p.m.	·478	N.W.	5	N.W.	33·7	30·7
6 p.m.	·462	N.N.W.	2	N.W.	33·3	30·7
8 p.m.		N.N.W.	1	...	...	...
11 p.m. ...	29·601	0	0	0	26·7	25·6
25th :—						
1.15 a.m. ...	...	...	..	...	29·1	29·0

Max. temp. 48°·7 ; min. temp. 25°·4 ; min. temp. on grass, 20°·2.

Intense white frost ; 8 a.m., very fine, thin linear cirri pointing in various directions and crossing each other, the majority pointing N.W. and S.E. ; at 10 a.m., slight solar halo ; 0.45 p.m., slight snow ; from 0.50 p.m. till 1.50 p.m., heavy snow storm ; for the first half-hour the flakes were small, then larger ; snow ceased at 3 p.m. The snow-storm moved in a W.N.W. current ; the ground was covered 1 inch deep, and the snow when melted yielded 0·051 in. of water. The temp. was 28°·3 during the storm ; after the storm, prospect very clear ; 6 p.m., much ice, and ground white with snow. From 8 p.m. to 10.30 p.m. much lightning in S. and S.W.—Yours truly,

E. J. LOWE, F.R.S.

Highfield House Observatory, March 24th, 1878.

SIR,—After reading Mr. Clement Ley's article on the above subject in the current number of the *Meteorological Magazine*, I am tempted to send you a few particulars of the squall as noticed by me.

Sunday, the 24th March, broke here a brisk, wintry day, with all appearance of fine weather, so much so that many neighbours predicted a fine day, but, warned by a rapidly falling bar., and other symptoms of approaching change, I judged it well not to venture out without an umbrella. I was prevented from seeing its approach, being in Church at the commencement, but at 11.45 a.m. I noticed it growing gradually darker, the sky becoming overcast, and a few flakes of snow falling.

Believing that a storm of no ordinary occurrence was about to burst,

I took particular notice (as far as I could from the interior, and the nature of my occupation would allow), and at 11.55 a terrific squall seemed to suddenly strike the building, accompanied by blinding snow and a sudden darkness (caused by the density of the snow-cloud), which lasted several minutes. For fifteen minutes the wind howled in a fearful manner, after which it gradually subsided, and at 12.35, upon coming out, I found snow 2 inches deep on the level road, and five minutes afterwards snow ceased to fall. The wind then again increased, and blew with much force from the N., drifting the snow. Much snow afterwards fell from 4 to 8 p.m. Appended are tabulated remarks :—

Storm commenced.	Snow ceased to fall.	Wind before Storm.	During storm.	Rainfall following morning.
11.55 a.m.	12.35 a.m.	N.	N.	0.35 in.

—Yours truly,

Bishop's Castle, Shropshire, 23rd April, 1878.

E. GRIFFITHS.

THE WEATHER IN APRIL.

At the beginning of the month two atmospheric depressions were shown over the United Kingdom, the larger a little to the southward of the Shetlands, and the subsidiary one over the N.E. of France; the mercury was falling over all Western Europe, but was rising slightly in Sweden. The smaller depression disappeared, and on the 2nd the larger one was still shown, then over the North Sea, but it was apparently filling up, and the barometer rose everywhere. Pressure was highest over Spain; the wind circulated round the low pressure, being north-westerly in Scotland, westerly over England and France, south-westerly in North Germany, and south-easterly in Scandinavia, and was generally rather strong in force. Aurora was seen in the evening of the 2nd.

On the 3rd pressure was still increasing over the whole of Western Europe, but the general distribution remained the same as on the previous day, being relatively high over the S.W. of France and the north of Scandinavia, while an area of low pressure lay over the North Sea. During the day pressure began to decrease in the S.E., and a shallow depression lay over the N.E. of England. This depression subsequently advanced south-eastwards and lay over the Sound; the barometer had risen over nearly the whole of Western Europe; readings were comparatively uniform, and became more so during the day, the pressure continuing to increase.

A small local depression lay over Wales on the 5th. Very light and variable airs prevailed. Heavy snow and rain fell in Sweden, and a smart thunderstorm was felt over S. England; the small depression noticed above passed across, but caused no change of importance. After this a complete change came over the distribution of pressure over Western Europe. From the 7th to the 10th pressure was highest in the N. of Sweden, and depressions advanced to our S.W. coasts from the Bay of Biscay; that of the 7th and 8th occasioned rather steep gradients, and a strong to moderate south-easterly gale prevailed all round our coasts. On the 10th the general distribution of pressure was not much changed, except that the shallow depression, which on the previous day lay over the Bay of Biscay, advanced northward and was shown over the N.W. of France and the mouth of the Channel. The highest readings continued steadily over the N. of Sweden. Pressure was increasing except in the S. and S.E. of England—the change in the S.W. of France being rather brisk. The shallow depression continued to advance, and in the evening its centre lay between Hurst Castle and Plymouth, while the area of wet weather extended from the S.W. counties to London. During the night a fall of rain occurred, being heavy at both Oxford and Portishead, was extraordinarily so in London, where from midnight to 8 a.m. on the 11th the fall was at the rate of .2 in. per hour at Brixton, and even heavier at Greenwich. This fall continued, though in a lesser degree, down to 2 p.m. of the 11th, the

total fall in the 21 hours being 2·8 in. In other parts of the country the weather was dry; the fall in London seems to have been very local.

On the 12th a rather deep depression advanced to the S. of Ireland, and the day after the mercury fell over all Western Europe, the change being greatest in the N. of Ireland. A large area of high readings lay over the south of Scandinavia, the North Sea, North Germany, and E. of France, while the depression noticed above was passing slowly northward along the W. coast of Ireland. In London a sharp shower occurred in the afternoon.

From the 14th to the 20th the distribution of pressure considerably changed, but the change was gradual and unaccompanied by any important disturbance. On the 14th pressure was highest (30·1 in.) in the east of France, and lowest (29·7 in.) off our western coasts, while numerous slight depressions were shown passing northward. Next day pressure gave way over Scotland, England, and France, but the changes were slight. Several subsidiary depressions advanced from the Atlantic to the west coast of Ireland in a northerly direction, but these caused no alteration in the distribution of pressure elsewhere. On the 21st a well defined area of low readings was shown in the S.W., but this filled up in the course of this day and the following one.

On the 23rd the mercury fell half-an-inch in the N.W. of France, and the decrease in pressure which had begun in the S.W. on the previous day spread to all parts of Western Europe. A well-defined depression (29·4 in.), which had apparently advanced from the south-westward across the Bay of Biscay, lay off the N.W. of France, while an area of high pressure (30·2 in.) lay over the S. of Norway and Sweden. The wind in the south was cyclonic, and circulated round the centre of low pressure, while in the N. and E. it was easterly to south-easterly and anticyclonic; it blew a gale at Corunna. During the day the depression advanced a little eastward, and the next morning was found off the N.W. of France, but was apparently filling up, while the highest readings appeared over the Shetlands. The depression again altered its position and was shown over the N.E. of France on the 25th, but had become unimportant. No particular barometric change occurred (pressure being very uniform throughout W. Europe) until the 28th, when an anticyclone lay over the S.E. of England and the Netherlands. The barometer fell in the N. of Scandinavia somewhat briskly, and to a less extent over Scotland, Ireland and France; while in the S. of France the mercury rose. The weather was fine and dry over the whole of Western Europe.

The mercury continued to fall in all parts of the United Kingdom and France, but rose briskly in Sweden, the gradients for south-easterly winds becoming steeper over the United Kingdom, but no strong winds were experienced from that quarter, the gradients becoming much slighter on the 30th. On this day pressure was relatively high in the S. of France and over Scandinavia, while it was lowest in the neighbourhood of Valentia. Rain fell over the greater part of England and France, but on the eastern shores of the North Sea the weather was clear.

H. E. M.

THE COMING SUMMER.

To the Editor of the Meteorological Magazine.

SIR,—Some time ago I constructed from the Greenwich daily mean temperatures (1814 to the present time) a table of monthly means, in which the month was reckoned from the middle of one calendar month to the middle of the next, and so on. The following striking rule is an interesting result of a study of this table:—

When the Greenwich mean temperature of the period from the 15th of February to the 16th of March inclusive, is about or above 44°, the succeeding summer is always warmer than the average. When over 44½° in the period referred to, the following July has always been a very hot month, and generally the whole summer is decidedly hot.

Your readers may perhaps like to see the whole series of this particular month of the table, so I give it below :—

Year.	Mean temp. of Feb. 15th to March 16th inclusive.	Difference of mean temp. of following June to Aug., from avg. of 60 years.	Year.	Mean temp. of Feb. 15th to March 16th inclusive.	Difference of mean temp. of following June to Aug., from avg. of 60 years.	Year.	Mean temp. of Feb. 15th to March 16th inclusive.	Difference of mean temp. of following June to Aug., from avg. of 60 years.
	deg.	deg.		deg.	deg.		deg.	deg.
1814	30.2	—3.1	1836	37.1	—0.5	1858	34.5	+1.7
1815	43.1	—1.4	1837	38.8	—1.0	1859	46.3	+3.5
1816	39.9	—5.7	1838	37.9	—1.7	1860	34.4	—4.1
1817	42.2	—3.4	1839	37.2	—1.5	1861	44.1	+0.3
1818	39.7	+3.4	1840	35.6	—1.0	1862	41.8	—2.5
1819	40.3	—0.2	1841	43.2	—2.6	1863	41.8	—0.5
1820	37.1	—2.8	1842	42.6	+2.0	1864	38.8	—1.2
1821	38.4	—3.0	1843	38.2	—1.0	1865	37.8	+0.5
1822	44.3	+1.3	1844	38.8	—0.9	1866	36.6	—0.4
1823	38.7	—2.7	1845	32.1	—1.5	1867	39.4	—1.0
1824	39.4	—1.6	1846	46.3	+3.5	1868	44.7	+3.6
1825	39.7	+1.2	1847	39.1	+1.0	1869	39.5	—0.6
1826	44.8	+3.2	1848	41.9	—1.3	1870	38.7	+1.7
1827	38.7	—0.8	1849	43.9	+0.2	1871	43.4	—0.4
1828	43.3	—1.5	1850	43.7	+0.3	1872	45.5	+0.9
1829	37.7	—1.9	1851	39.9	+0.2	1873	37.8	+0.9
1830	41.6	—2.0	1852	38.7	+0.8	1874	38.8	+0.1
1831	42.5	+1.5	1853	37.0	—1.3	1875	36.8	—0.4
1832	36.4	—0.4	1854	42.4	—1.8	1876	44.6	+1.9
1833	38.4	—1.4	1855	34.1	—0.4	1877	40.0	+0.5
1834	45.8	+1.7	1856	39.0	+0.3	1878	45.6	...
1835	41.0	+1.7	1857	41.1	+3.2			

The years in which the mean temperature of the period from the 15th February to the 16th March, was within a small fraction of 44° , will be seen to have been 1849, 1850, and 1861, and the mean temperatures of the following summers (June to August inclusive) were respectively $0^{\circ}2$, $0^{\circ}3$, and $0^{\circ}3$ above the average of 60 years. In 1822, when the mean of the period was just below $44\frac{1}{2}^{\circ}$, the following summer was $1^{\circ}3$ above the average, but in 1826, 1834, 1846, 1859, 1868, 1872, and 1876, when the period referred to in the above table was above $44^{\circ}5$, the following summer, or the following July, was in each case remarkably hot. In 1826, July was $3^{\circ}5$ above the Greenwich average of 60 years. In 1834 that month was $2^{\circ}0$ above the average, in 1846 $2^{\circ}4$ in excess, in 1859 $6^{\circ}0$ in excess, in 1868 $5^{\circ}4$ above, in 1872 almost $3^{\circ}0$ above, and in 1876, that month was $3^{\circ}8$ above the average. This year the mean of the period referred to was $45^{\circ}6$; so according to this rule, we have good reason to believe that unusually hot weather will occur during the coming summer, and that the hot periods will be of considerable duration. It will be seen from the above table, that although we have always had a warmer summer than the average, after the mean temperature of the period referred to has been about or above 44° , we have sometimes had a hot summer without this particular sign having preceded it.

As regards cold summers, the converse of the rule I have given is

generally true, for, whenever the mean temperature of the period referred to in the table has been below $34\frac{1}{2}^{\circ}$, the following summer has been colder than the average. A glance at the above table will show that the years when the mean temperature of the period was below $34^{\circ}5$ were 1814, 1845, 1855, and 1860, and in each case the succeeding summer was colder than the average. In 1858 the mean of the period was just $34\frac{1}{2}^{\circ}$, and, although June was a very hot month, the following month of July was as much as $1\frac{1}{2}^{\circ}$ colder than the average. In most cases when the period has been below 37° or 38° , the succeeding summer has been colder than the average, as in 1820, 1829, 1832, &c.—Yours very sincerely, GEORGE D. BRUMHAM.

Barnsbury, 2nd April, 1878.

SUPPLEMENTARY TABLE OF RAINFALL IN APRIL, 1878.

[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	2.50	XI.	Solva	2.42
	Littlehampton	2.56		Castle Malgwyn	1.73
	Hailsham .....	...		Nantgwilt, Rhayader ...	3.22
	St. Lawrence, I. of W....	2.78		Carno	2.60
	Strathfield Turgiss	2.23		Rhug, Corwen	1.46
III.	Addington Manor	2.52		Port Madoc	1.84
	Oxford	2.25	XII.	Carsphairn	3.34
	Northampton	1.84		Melrose	2.09
	Cambridge	1.44	XV.	Gruinart	2.52
IV.	Sheering	1.78	XVI.	Grandtully .....	...
	Diss .....	.98	XVII.	Tomintoul .....	.43
	Swaffham	1.11		Keith .....	.37
V.	Alderbury, Salisbury ...	2.65	XVIII.	Dalwhinnie .....	.50
	Compton Bassett	2.34		Achuasheen	1.38
	Dartmoor	5.19		Springfield, Tain .....	.32
	Teignmouth	5.47		Glenfinnan	3.64
	Langtree, Torrington ..	2.81	XIX.	Watten	1.04
	Cosgarne, St. Austell ...	3.99	XX.	Glenville, Fermoy	3.57
	Taunton	3.80		Tralee	2.35
VI.	Bristol	2.98		Tipperary	2.76
	Sansaw	1.86		Newcastle W., Limerick	1.81
	Cheadle	2.20		Kilrush	2.22
	Bickenhill Vicarage	1.97	XXI.	Kilkenny	2.38
VII.	Coston, Melton Mowbray	1.56		Kilsallaghan	3.62
	Bucknall	1.16		Twyford, Athlone	2.15
VIII.	Walton, Liverpool	1.31		Belvedere, Mullingar ..	...
	Broughton-in-Furness ..	2.58	XXII.	Ballinasloe	1.73
IX.	Stanley, Wakefield	2.20		Kylemore	6.00
	Mickley, Ripon	2.11		Carrick on Shannon	2.39
	Whitby .....	...	XXIII.	Rockcorry	1.60
X.	Gainford	1.84		Warrenpoint	2.67
	Unthank Hall	2.49		Newtownards ...	1.78
	Shap	2.92		Bushmills	1.82
IX.	Llanfrechfa	4.60		Buncrana	2.74

APRIL, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which ≥ 1 or more fell.	Max.		Min.		In shade	On grass	
				Dpth	Date.		Deg.	Date.	Deg.	Date.			
inches	inches.	in.											
I.	Camden Town	4.97	+ 3.84	2.56	10	16	69.4	30	27.2	1	5	11	
II.	Maidstone (Hunton Court)...	3.62	+ 2.47	1.67	10	15	...	...	...	...	...	...
	Selborne (The Wakes).....	2.80	+ 1.30	.78	10	20	65.0	28	28.0	1	6	9	
III.	Hitchen	2.35	+ 1.35	.86	10	16	65.0	30	28.0	5	5	...	
	Banbury	2.27	+ 1.11	.54	10	18	65.0	28	25.0	1	8	...	
IV.	Bury St. Edmunds (Culford)...	1.23	+ .48	.37	23	9	69.0	30	25.0	5	5	10	
	Norwich (Sprowston).....	1.68	...	.85	16	10	...	...	...	...	...	...
V.	Bridport	3.53	+ 2.05	.59	9	18	...	...	...	...	...	...
"	Barnstaple.....	2.53	+ .52	.40	18	18	67.0	29	35.0	1,6	0	...	
"	Bodmin	3.25	+ 1.55	.60	12	21	63.0	28	34.0	1	0	2	
VI.	Cirencester	3.02	+ 1.73	.85	10	20	...	...	...	...	...	...
"	Shifnal (Haughton Hall) ...	1.93	+ .78	.47	23	15	63.0	29	25.0	1	6	11	
"	Tenbury (Orleton)	2.56	+ 1.02	.48	10	20	65.2	30	25.3	1	6	7	
VII.	Leicester (Town Museum) ...	1.57	...	.47	20	14	64.0	29	27.2	1	3	14	
"	Boston	1.19	+ .22	.54	20	10	68.0	29	24.0	1	5	...	
"	Grimsby (Killingholme).....	1.19	...	.54	20	10	64.0	15	26.0	1	2	...	
"	Mansfield	1.53	...	.61	20	14	65.0	29	25.0	1	5	11	
VIII.	Manchester (Ardwick).....	1.71	+ .29	.52	21	11	69.0	28	28.0	1	2	...	
IX.	York	1.30	+ .20	.49	20	7	65.0	15	29.0	1	3	...	
"	Skipton (Arncliffe)	2.74	— .30	1.09	20	11	...	...	...	...	...	...
X.	North Shields	1.88	+ .57	.52	20	13	61.2	16	28.2	1	2	4	
"	Borrowdale (Seathwaite).....	4.19	— 2.71	.77	3	11	...	...	...	...	...	...
XI.	Cardiff (Crockherbtown).....	4.10	...	.75	9	21	...	...	...	...	3	...	
"	Haverfordwest	2.76	+ .90	.55	13	13	63.0	29	29.0	5	3	8	
"	Aberdovey.....	1.68	...	.34	29	14	75.0	28	27.0	1	2	...	
"	Llandudno.....	1.39	— .11	.26	3	12	70.7	12	34.0	1	0	...	
XII.	Dunfries (Crichton Asylum)...	3.36	...	1.18	20	12	63.4	29	27.0	6	7	10	
"	Hawick (Silverbut Hall) ...	1.90	...	.50	19	13	...	...	...	...	...	...
XIV.	Glasgow (Cessnock Park) ...	2.46	+ .64	...	...	...	...	...	...	...	...	...
XVI.	Mull (Quinish)	2.67	...	.98	20	14	...	...	...	...	...	...
"	Loch Leven	1.70	+ .18	.60	21	...	...	...	...	...	...	...
"	Tyndrum (Ewick)	4.50	...	...	...	...	...	...	...	...	...	...
"	Arbroath	1.41	+ .22	.30	1,16	11	61.0	14*	30.0	2	6	...	
XVII.	Braemar .....	.82	— .58	.45	20	5	59.2	30	20.0	6	11	21	
"	Aberdeen .....	.96	...	.20	17	15	62.6	14	28.4	2	3	7	
XVIII.	Gairloch .....	.64	...	.30	1	7	...	...	...	...	...	...
"	Portree	2.15	— 3.12	.39	20	14	...	...	...	...	...	...
"	Inverness (Culloden) .....	.37	— 1.10	.16	2	8	64.9	29	30.0	6	6	15	
XIX.	Dunrobin .....	.35	— .89	.20	1	6	60.0	14	29.8	1	7	...	
"	Sandwick .....	.24	— 1.50	.09	15	6	57.0	16	28.8	1	3	7	
XX.	Caherciveen Darrynane Abbey	3.99	...	1.53	12	17	...	...	...	...	...	...
"	Cork	4.85	...	1.30	9	15	...	...	...	...	...	...
"	Waterford	3.72	+ 1.49	1.20	13	14	60.0	24	30.0	1+	5	...	
"	Killaloe	1.73	— .40	.53	20	15	70.0	30	25.0	4	8	...	
XXI.	Portarlington	1.47	— .55	.37	12	19	62.0	16	28.0	3	8	...	
"	Monkstown, Dublin	1.63	— .01	.62	29	12	70.0	26	28.0	1||	5	...	
XXII.	Galway	2.50	...	.57	12	18	66.0	20	29.0	2	4	...	
XXIII.	Waringstown	1.68	...	.77	12	17	66.0	19	28.0	1,2	5	11	
"	Edenfel (Omagh)	1.92	...	.82	12	13	62.0	19+	28.0	2,3	5	...	
"	Ballyshannon	1.12	...	.40	4	5	...	...	...	...	...	...

* And 15.

+ And 22, 29.

‡ And 2, 4, 5.

|| And 7, 19.

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

METEOROLOGICAL NOTES ON APRIL.

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.

CULFORD.—The weather throughout the month was favourable, with a mean temp. above the average ($49^{\circ}\cdot 1$); swallows first seen and nightingale first heard on the 18th, cuckoo first heard on 29th, TS, with H, on 23rd.

BODMIN.—Mean temp. of month $46^{\circ}\cdot 8$, being $4^{\circ}\cdot 1$ below average.

SHIFNAL.—On the whole a genuine April, although it came in with a "white world" and frosts; for the first nine days the ther. never rose to 50° , and was below 32° at night; from that time the temp. rose, and it was genial weather with fine showers; pastures unusually forward, but the severe frost of the 1st damaged gooseberry and apricot blossoms. Bar. very equable throughout, and little wind; damson in blossom on 10th, wild cherry on 16th, stitchwort flowers on 12th, asparagus cut on 20th, sand martins arrived on 11th, willow wrens on 15th, cuckoo seen 17th, heard 27th, swallow seen 25th.

ORLETON.—The weather was dry and cold, with severe frosts almost every day till the 10th, when a gentle rain set in at 6 p.m., and continued till nearly 9 a.m. on the following day. It was afterwards warm, with frequent R and very favourable for vegetation; mean temp. slightly below the average; distant T on the 5th, 17th, 19th and 30th; cuckoo heard and swallows seen on 16th, chaff-chaff on 18th, early plums in full bloom about 5th, damsons on 14th, and cherry trees on 19th.

BOSTON.—On the 5th a very heavy rain fell on the E. coast, at the villages of Frieston and Butterwick, which was scarcely felt here. The inhabitants report that the rain was quite black, and made the water in the ponds, ditches, and tanks quite dark-coloured. The temp. on the night of the 1st was the lowest recorded during the last 14 years.

MANSFIELD.—S and R on 1st, lunar halo on 8th, T on 14th, 24th and 30th.

MANCHESTER.—The month opened with cold ungenial weather, easterly winds set in on 5th and prevailed to the 12th, when we had some genial showers, which were very beneficial to vegetation. On the 21st cold E. wind set in again, but the weather was fine, and continued so to the close of the month.

YORK.—Mean bar. nearly half-an-inch below last month; wind E. on 19 days, bringing several almost cloudless days at end of month. Vegetation rather backward; first swallow seen on Good Friday.

ARNcliffe.—S and sleet on 1st; very cold N.E. wind on 8th.

NORTH SHIELDS.—S on 1st and 2nd.

WALES.

HAVERFORDWEST.—Very fine growing weather; the finest April for many years; heavy gale from E. on 7th and 8th, with S showers; air very cold at this time, and again during the last six days; vegetation much more forward than for many years past.

ABERDOVEY.—A fine warm month, with the exception of two nights of frost, and the prevalence of easterly wind for about half the month; most genial R at the close of the month.

LLANDUDNO.—A fine spring month, without any frost; all crops looking well. Mean temp. about half a degree above average, in spite of a general prevalence of polar winds. Plum and cherry in bloom on 3rd, sycamore in leaf on 18th, apple in blossom, and swallows seen on 19th, oak and elm in leaf on 23rd, chestnut in flower on 25th, ash in leaf on 29th.

SCOTLAND.

DUMFRIES.—The rainfall, one-third of which fell on one day, is rather below the average; mean temp. about the average; easterly winds prevailed during the greater part of the month, and the weather was therefore rather ungenial.

HAWICK.—Heavy snowstorm on 1st ; frosty for the first nine nights. The late rains drowned out the bees. I have only seen one alive here this season. On the morning of the 3rd a shower of S fell near to Cavers, and so limited was the fall, that only one large field, and a small strip of ground were covered white, while all the surrounding district was free from S.

QUINISH.—A very fine warm month, vegetation and foliage as far advanced at the end of the month as they were in the beginning of June last season.

ARBROATH.—Foggy for the last ten days of the month.

BRAEMAR.—A very excellent but dry month.

ABERDEEN.—A month of rather mild and dry, but somewhat dull weather ; mean height of bar. a little below 21 years' average ; mean temp. $44^{\circ}9$, or $0^{\circ}8$ above average of 21 years ; rainfall 1.17 in. below 21 years' average.

PORTREE.—A very fine month ; farming operations carried on briskly, and sowing nearly completed ; grass backward from want of rain, and lambs suffering slightly on dry farms.

DUNROBIN.—With one or two exceptions the driest month we have had in Sutherland for the last ten years ; easterly winds prevailed most of the month ; atmosphere cold and dry, slight frosts at night early in the month, but vegetation is healthy, and so far promises well.

IRELAND.

WATERFORD.—Mean bar. 29.82 in. ; mean temp. 45° ; wind N. and S. ; H and rainbow on 3rd.

KILLALOE.—Deficient rainfall and E. winds. Some sharp frosts in the early part of the month. Rising temp., and vegetation very good at end of month.

MONKSTOWN.—The earlier part of the month was very cold, with N. and E. winds. The remainder was fine and warm, with some heavy showers ; vegetation progressing rapidly.

WARINGTOWN.—Very favourable for farming operations ; the crops better got in than for many years past.

EDENFEL.—The most exacting farmer could not desire April weather more favourable than that of the past month. With drought sufficient for all tillage purposes there was rain and warmth sufficient to produce a luxuriance of vegetation, to which we have long been strangers at this season.

BALLYSHANNON.—The month was unusually fine and favourable for spring work ; the temp. was high and there was no frost to damage fruit trees, which promise an abundant crop.

METEOR IN SUNSHINE.

To the Editor of the Meteorological Magazine.

SIR,—It may interest you and the readers of your journal to know that yesterday, the 25th, I saw a magnificent meteor in broad daylight, the sun shining in an unclouded sky at the time. The time was 10.17 a.m. ; the position of the meteor was a little to the east of true north, (I had nothing to guide me in this except the sun, as I was walking along the road) ; the direction (falling) was perpendicular to the horizon ; the train some five to six deg. long. ; its size seemed at least equal to 3' or 4' of arc ; in brilliancy it was something marvellous, apparently equal to that of the sun, *proportionately* ; it lasted from four to five seconds. Its brightness may be imagined from its brilliant appearance during intense sunlight.

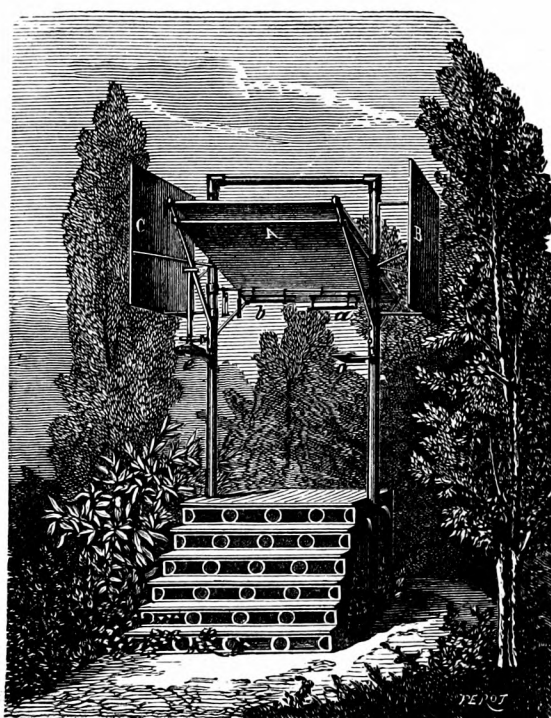
I shall be interested to know if anyone else observed it. Two men walking along at the same time saw it on my calling their attention to it.—Yours truly,

WM. GARNETT, F.R.A.S.

Bashall Lodge, Clitheroe, March 26th, 1878.

[Probably the same as reported from near Hawick. See p. 48.—*Ed.*]

ABRI DES THERMOMÈTRES DE MONTSOURIS,



MONTSOURIS THERMOMETER STAND.

S Y M O N S'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CXLIX.]

JUNE, 1878.

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METEOROLOGY AT THE PARIS EXHIBITION.

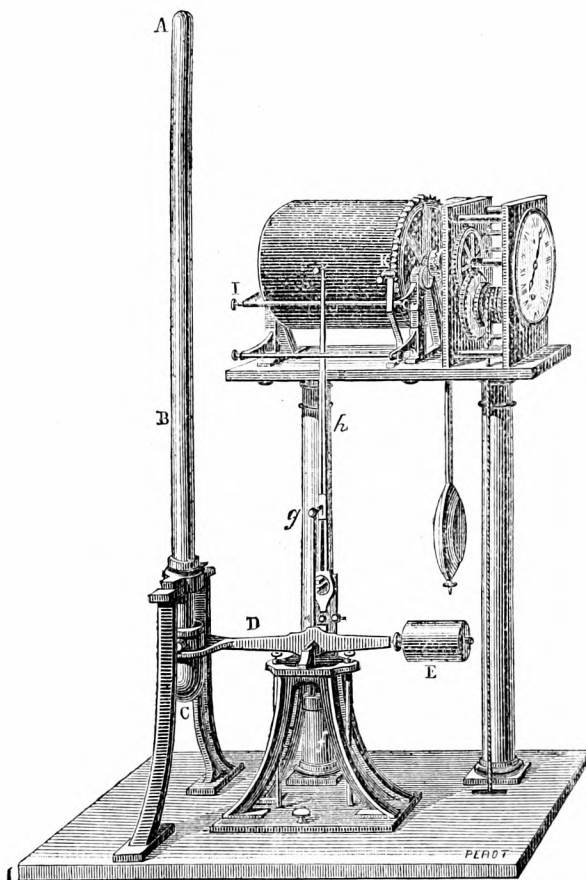
(*Continued from page 52.*)

THE temporary Montsouris Observatory contains several instruments besides those already mentioned. There are, for instance, a self-recording electrometer, a set of ordinary thermometers, and a **Salleron's Recording Barometer**. As we do not think that any balance barometer has yet been described in this magazine, we will give a brief notice of the one exhibited. It may be well to go back to the very simplest statements, in order to prevent any possibility of this really very simple instrument being misunderstood. Suppose that an ordinary barometer were hung on a balance, it is evident that it would always weigh the same, no matter what the barometric reading, as it would be of no consequence whether the mercury were in the cistern or the tube. Sometimes the cistern is fixed and the tube hung on a balance; according to Everett* this plan was adopted by Samuel Morland in 1680, but we should be glad to know where the description is to be found. In M. Salleron's instrument the tube is fixed and the cistern moveable, and this being premised, the engraving on page 66 will render the general features very easily understood. A B is the fixed barometer tube of which the internal diameter is nearly $1\frac{1}{4}$ inches; C is the cistern attached to the arm D of the balance, and counterpoised by the weight E; from the centre of the balance a long indicator passes upwards, and has at its extremity a needle point which scratches the smoke-blackened cylinder K, nearer to I when the barometer falls, and nearer to K when it rises. The cylinder K of course revolves by clock work in the usual manner.

We ought not to pass over without mention the **Aeroscope**, a small vane carrying a curved glass tube through which atmospheric air is constantly passing, so that the dust and animal and vegetable matter floating in it may be collected for analysis. We are not aware that such experiments are being tried anywhere except at Paris and Glasgow. Although we certainly cannot prevent the existence of dust

* Deschanel's "Natural Philosophy," p. 158.

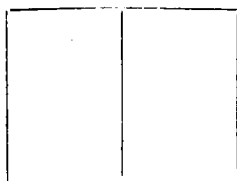
in the atmosphere, it is of interest to know its characteristics, and how much of the sad total of human disease is traceable to it.



Meteorology and Agriculture.—It is satisfactory to think that our Meteorological Council have begun to do something towards providing materials for comparing meteorological data with agricultural results ; far too little has hitherto been done in that direction, and even of that little, other countries have left ours behind. We talk of scientific farming, but we saw no meteorological statistics in the English agricultural department, while Denmark shows a very interesting set of seasonal charts of the distribution of temperature and rain in connection with agricultural products. No one can entertain a shadow of doubt that meteorology could largely benefit agriculture ; why is there a chasm between them ?

Ponti, of Venice, sends the most unusual **Telescope** we have ever seen. It is about 5 ft. long, and consists of two telescopes close together, something like an enormous race glass, but the tubes are

rectangular, and the object glasses being large, the two tubes join and form one rectangular figure, somewhat thus—



There is separate rackwork for focussing each eye piece, an arrangement which it seems to us might, with advantage, be applied to the best quality of race glasses, for there are few persons whose two eyes are of precisely equal focus. The telescope is brilliantly lacquered, and mounted upon a handsomely carved stand, with the names (and busts if we are not mistaken) of Galileo, Dollond and Schneider. Altogether the instrument is quaint in the extreme; we can scarcely imagine anything which would harmonize better with the present antique style of domestic furniture, and we should think that for ordinary purposes it must be as agreeable to use as it is handsome in appearance.

As to meteorological apparatus in general we did not see any, except from Italy, Russia, England, Switzerland, and France, and our estimates of the value of the exhibits is given by the order in which we have named the countries; those from Switzerland and France being far ahead of all the rest. The exhibits from Italy and Russia do not call for any notice, and England has but two or three exhibits of meteorological apparatus. Fortunately **Negretti and Zambra** have sent a collection, which includes most of the patterns employed in this country, and fully maintains the reputation of the firm. Their extremely clever turn-over thermometer appears in several forms, both as adapted for observations of sea temperature at any depth and also attached to clocks for giving hygrometric observations at any hour of day or night without the attendance of the observer. Of the extreme excellence of this **Self-recording Hygrometer** we cannot speak too highly. We may also direct attention to a large bore **Standard barometer**, the workmanship of which is superior to that of any other in the building.

Cetti, of Brooke-street, Holborn, is better known for high class work in glass blowing than for strictly meteorological apparatus. The gems of his case are some glass tubes with threads turned on their ends and sockets running on them as truly and as perfectly air tight as possible; his glass taps and stopcocks are also extremely good. He exhibits a very large Six's thermometer, which is almost equally remarkable for two features; first, for the difficulty of making it, and secondly, for that of having conveyed it to Paris without disarrangement; of course it has no claim to be considered as a strictly scientific instrument. It is quite otherwise with some of Mr. Cetti's **thermometers** which are extremely good. One or two new methods may be mentioned,

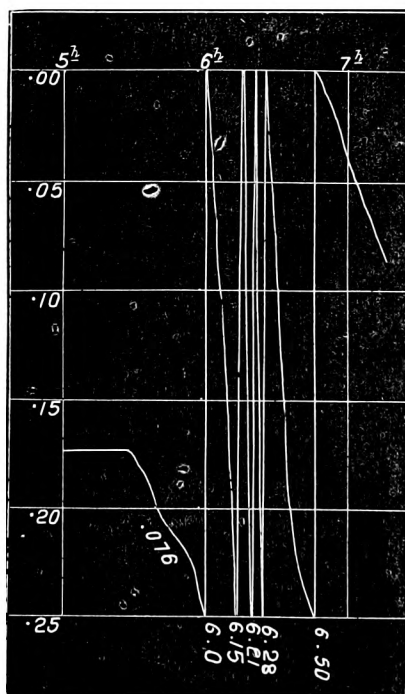
Double Scale Thermometers, *i.e.*, Centigrade and Fahrenheit divided on the tubes; this is done by making the tubes triangular, and putting one scale on each of the two front faces. His **Solar Radiation Thermometers** are held in their places inside their jackets by glass alone, so that the errors produced by using cork, india-rubber, &c., are entirely avoided. There is also a very handsome Wheel Barometer.

We saw the large **Recording Aneroid** which Mr. Pillischer exhibited at the Loan Collection at South Kensington, in the hall of the British Commission; whether or not it has been moved into the main building we are not aware. The same maker exhibits an equatorial, of which, without trial, it is impossible to give a fair verdict, but appearances are much in its favour, far more so than they are to one shown by Dallmeyer, which is quite ablaze with lacquer, and the appearance of which after twelve months' work will be far inferior to its less gaudy companion.

(To be continued).

HEAVY RAINFALLS, MAY 6TH-9TH.

THERE were several heavy falls of rain between May 6th and 9th, but the heaviest of which we yet have particulars was that at Greenwich, in the afternoon of the 6th, and we are therefore glad to be able to give a reproduction of the trace of the self-recording rain gauge on the roof of the Royal Observatory during the heaviest part of the fall.



It will be seen that the fall was—

Up to 6. 0 p.m.	...	0.076							
From 6. 0 to 6.15	„	0.250	being	.250	in 15 min.,	or 1.000	per hour.		
„ 6.15 to 6.21	„	0.250	„	.250	„ 6	„	3.000	„	
„ 6.21 to 6.28	„	0.250	„	.250	„ 7	„	2.143	„	
„ 6.28 to 6.50	„	0.250	„	.250	„ 22	„	.682	„	
„ 6.50 to 9.30 a.m., 7th		0.524							
TOTAL		...	1.600						

At *Tenterden* the rain began at 4.45, and at 5 p.m. .17 in. had fallen, by 5.25 .34 in., by 5.35 .47 in., and by 5.45, or in one hour, .59 in. fell. In the next hour the fall was .18 in., and by 9 p.m. the total was .97 in., and by 9 a.m. on 8th it was 1.30 in.

At *Camden Square* the heaviest fall was between 5.10 and 5.31 p.m. on the 6th, in which 21 minutes 0.65 in. fell; from 5.31 to 5.46 there was a further fall of .18 in., making .83 in. in 36 minutes, and subsequent steady rain brought the total up to 9 a.m. on 7th to 1.71 in.

At *Branch Hill Lodge, Hampstead Heath*, 1.30 in. fell between 5 and 6 p.m. on 6th, and 0.56 afterwards, making the total to 9 a.m. on the 7th, 1.86 in.

At *Uppingham*, the fall for the 6th was only 0.30 in., but steady rain began about 5 p.m. on 7th, and 1.35 in. had fallen by 9 a.m. on 8th, thence to 5 p.m. on 8th 0.63 in. more fell, making for Uppingham the unusual total of 1.98 in. in 24 hours.

At *Cambridge* there fell between 3 p.m. on 7th, and 9 a.m. on 8th, 1.10 in., and thence until 4 p.m. on 8th, 0.53 in.; total in 25 hours, 1.63 in.

THUNDERSTORM WITH HEAVY RAINFALL AT WORTHING, JUNE 8TH, 1878.

To the Editor of the Meteorological Magazine.

SIR,—The wind which had been W. and S.W. for some days previous “backed” suddenly during the forenoon of the 7th to S.E., and the barometer began to fall. The morning of the 8th broke fine with a fresh breeze from E.S.E., a sharp fall of the barometer took place during the night (0.223 inch), and the fall continued throughout the day, though at not so sharp a rate. Heavy masses of storm cloud gathered about after 1 p.m., and shortly after 3 p.m., large drops of rain fell; by 3.20 p.m. the rain was coming down both steadily and freely. The thunderstorm which had been threatening all the morning now began in earnest—the lightning being extremely vivid, and the thunder close, and apparently quite overhead—the rain descended in torrents, quite warm, and truly tropical in its nature.

Some hail fell about 3.30 p.m.; at 3.42 p.m. a most vivid flash of lightning occurred, followed instantaneously by a very terrific crash of thunder. There is no doubt, from what I have gathered since Saturday, that we were right in the centre of the path or track of the storm, as 7 miles westward and 10 miles eastward neither the storm itself nor the rainfall were of such a severe character. When the storm

was at its worst, the streets ran down in rivulets, and being pretty nearly on a dead level, the result was anything but satisfactory, considering the tide was high upon the beach, and the sewers were completely waterlogged. Shortly after 4.0 p.m. the storm gradually died away, and by 4.20 p.m. all rain had ceased. On returning home, I took the contents of the rain gauges, and found that both the 5-inch and the 8-inch measured exactly 1.00 inch, which had fallen in the course of 1 hour and 10 minutes. In all my experience since 1867, I do not remember such a heavy downpour in so short a space of time. Annexed are the various readings of

BAROMETER. Reduced to Sea Level.			THERMOMETER.						RAIN.
			Dry.	Wet.	Max.	Min.	Solar Max.	Grass Min.	
June 7	9 a.m.	30.184	59.8	56.7	...	...	...	...	...
" "	9 p.m.	.018	58.0	56.2	64.0	50.2	112.0	40.5	...
" 8	9 a.m.	29.795	61.2	57.7	...	...	...	...	1.00
" "	9 p.m.	.674	59.0	58.0	64.5	51.4	122.0	50.3	...
" 9	9 a.m.	.670	59.2	57.0	...	...	...	...	...
" "	9 p.m.	.626	57.2	55.0	63.5	55.5	123.0	51.1	...

— I am, Sir, yours obediently,

WM. J. HARRIS, F.M.S.

THE FRENCH METEOROLOGICAL SERVICE.

WE learn that M. Mascart has been appointed head of the meteorological bureau. He is professor in the College de France, his special subjects being light and electricity. He is author of a work in two volumes, on static electricity.

Last week we gave a brief sketch of the new organization of the French meteorological service by the government, and this week we are able to publish a translation of the decree, from which it will be seen how much alive the French government is to the national importance of a complete meteorological service. How Article 2, referring to "Titular Meteorologists," "Adjoint Meteorologists," and "Assistant Meteorologists," must surprise our "Meteorological" Council! In France they actually insist on meteorologists to do meteorological work and to advise upon meteorological matters.

Article 1. The meteorological division of the Paris Observatory forms a distinct service, which takes the title of "Bureau Central Météorologique." This service comprises the study of the movements of the atmosphere, meteorological advertisements to the ports and to agriculture, the organization of the meteorological observations, and of the regional or departmental commissions, the publication of their works, and the whole of the researches on meteorology or on climatology.

2. The meteorological service of France comprises titular meteorologists, *adjoint* meteorologists, and assistant meteorologists. The salary of the titular meteorologists varies from 3,000 to 10,000 francs. The *adjoint* meteorologists are divided into three classes, whose salaries vary from 2,500 to 5,000 francs. The assistant meteorologists are divided into two classes, whose salaries vary from 1,500 to 2,000 francs. This staff is distributed among the central bureau and the regional or departmental observatories, in proportion to the needs of these establishments.

3. The scientific staff of the central bureau comprises a titular meteorologist acting as director, two titular meteorologists placed under him, *adjoint* meteorologists, and assistant meteorologists. One of the *adjoint* or assistant meteorologists acts as secretary of the central bureau.

4. The director is charged with the general service of the establishment, the correspondence, the presentation to the minister of the proposed annual budget, the meteorological service, and a detailed account of the yearly expenses. He ought to secure the co-ordination and execution of the works which demand the concurrence of the different services placed under his orders, and see to the regularity of the publications. No order may be given without his authorisation.

5. The scientific works are divided as follows :—(1) Service of advertisements to the ports and to agriculture. (2) Service of the general movements of the atmosphere. (3) Service of climatology and of inspections. Each of the chiefs of the service remits monthly to the director a summary report on the progress of the works, and brings directly before the committee, instituted in the following article, the scientific questions of the service.

6. The heads of the service meet each month, on a fixed day, under the presidency of the director. This committee may hold extraordinary meetings at the instance of the director.

7. The titular meteorologists and the director are nominated by decree, on the proposition of the minister, and after the advice of the council, to be spoken of afterwards. The *adjoint* and assistant meteorologists are appointed by orders after advice of the same council.

8. The heads of the regional meteorological observatories are placed under the authority of the director of the central bureau. Each of these officials addresses to the central bureau, under cover of the minister, the observations and works of his establishment. He proposes to the council, through the director of the central bureau, the advancement of the meteorologists under his orders.

9. The meteorological observatories and stations of every order will be visited annually by the meteorologist of the central bureau charged with the service of climatology and inspections. They may also be visited by the director of the bureau or by a member of the council appointed for that purpose. In cases where the departments or towns contribute to the expenses of a meteorological observatory, the inspection will take place in company with the delegate of the general or municipal council interested.

10. There is established beside the central meteorological bureau, a council composed of (1) A representative of each of the Ministries of Agriculture and Commerce, of Public Works, of War, Marine, Foreign and Home Affairs and of the Administration of Telegraph Lines ; (2) Two delegates from the Ministry of Public Instruction ; (3) Two members of the Academy of Sciences ; (4) The director of the central bureau. The heads of the special service of the bureau are admitted to the council, with a consultative voice for questions which interest them. The members of the council are appointed for three years, by decree, on the proposal of the Ministry of Public Instruction.

11. The council of the central bureau will meet once every quarter on a fixed day. It may hold extraordinary meetings at the instance of the minister. The council gives its advice in the budget proposed by the director, on the construction of buildings or instruments intended for regional meteorological observations, on the collective investigations carried on in the various establishments, on the nominations and promotions of the officials, &c.

12. The president, vice-president, and the secretary of the council are appointed annually by the minister on the proposal of the council.

13. The council holds a general meeting yearly at which may be present the heads of the central bureau and of the regional observatories, the delegates of the regional and departmental commissions, and three delegates of the French Meteorological Society.

A regulation deliberated in council and approved by the minister will determine the mode and number of the delegations.

This meeting will hear the report of the president and council on the work of the year, and, if there are any, the reports and memoirs of the heads of the observatories that receive subventions, and those of the delegates of the regional or departmental commissions. It will discuss the views submitted to it, and transmit them to the minister. The report of the president will be printed.—*Nature*, May 30th.

GAINFORD RAINFALL.

WE need scarcely say more than that, following the precedent set some months since, Mr. Atkinson, of Gainford, has kindly supplied us with copies of a summary of his observations during the past ten years, and that a copy ought to be found enclosed with every copy of the present number. It may be well to add that Gainford is in the lower valley of the Tees, not far from the banks of the river, about five miles east of Rokeby, and half way between Barnard Castle and Darlington.

HEAVY LOCAL HAILSTORMS.

To the Editor of the Meteorological Magazine.

SIR,—Since I first came to this place, in March, 1874, no hailstorms worth mentioning have occurred here until the thundery period from the 18th to the 26th (inclusive) of last month. In this period we experienced hailstorms of a severity which was very remarkable indeed, considering that no very great amount of hail is reported to have occurred over the country generally. I send some notes of these storms.

The first, and by far the most severe, took place on the morning of May 18th. On the previous evening the S.W. wind, which had blown freshly, died down rather suddenly, and much cirro-stratus came over from S.S.W., radiating from the same point, while the sky at sunset continued clear in W.N.W., and nearly so in E.S.E. At 3.5 a.m. of the 18th, I was awakened by the thunder. At that time the sky was overcast (except in distant N.W., where it was clear), apparently with thick cirro-stratus and cumulo-stratus at a great height, moving from S.S.W. over a light E.S.E. breeze. Thunder and lightning were frequent 9 or 10 miles to S.E., and occasional overhead, with gushes of moderately hard rain. This continued and gradually increased for two hours, spreading slowly towards W. and N.W., while the clouds became increasingly stormy though still at a great elevation. Just before 5 a.m. the thunder and lightning increased in the immediate W., and in the zenith. At 5.5 the sky had almost cleared (and very suddenly) in the E., while immediately overhead hung one of the most awful-looking clouds that it has ever been my privilege to see. At this time the flashes were so near as to render observation somewhat unpleasant. Between the claps a very loud roar could be heard overhead, the cause of which was soon apparent. It began to rain and hail with excessive violence; and never before had I seen meadows which previously had no water visible on them covered with water in a few minutes. Most of the hailstones were of the size of small hazel-nuts, but mingled with these were others as large as walnuts. About one of these latter fell on every square foot of surface, as I should judge by their appearance after the storm, and by the rents made in glass, and the foliage of rhubarb, cabbage, &c. At 5.10 the surface-wind veered to S.S.W., and at 5.15 the storm ceased, thunder and lightning continuing, but

RAINFALL A

COUNTY

Latitude 54° 32' 53" N.

Diameter of Guage, 5 inches. Height above gr

YEARS 1868-1

Year		JAN.	FEB.	MAR.	APRIL	MAY	J
1868	Inches	2.330	0.660	0.610	2.600	1.020	0.
1869	"	3.310	1.400	2.070	1.540	3.490	1.
1870	"	1.560	2.140	1.350	0.450	0.520	1.
1871	"	1.070	1.540	1.070	2.860	1.280	3.
1872	"	3.100	2.740	4.410	2.490	1.000	2.
1873	"	1.810	1.200	2.280	0.660	1.920	1.
1874	"	1.810	1.540	1.100	1.250	2.860	1.
1875	"	2.380	1.210	0.840	0.840	1.060	1.
1876	"	0.305	1.960	3.245	2.680	0.720	2.
1877	"	4.215	1.520	2.580	3.800	2.270	1.
Average of 10 years each month	Inches	2.189	1.591	1.955	1.920	1.618	1.

The greatest fall occurred in 1872—41.010, followed

The average of the 4 years, 1868-71, was 25.117, suc

The average of the 4 years, 1874-77 was 30.330.

AVERAGE QUARTERLY

First Quarter, 5.735. Second Quarter, 5.286.

The Maximum and Minimum Fall

				INCHES.	
Jan.	1869	..	..	3.310	Maximum.
Apr.	1877	..	..	3.800	"
Sep.	1871	..	..	5.520	"
Dec.	1876	..	..	7.210	"

Gainford, by Darlington, June 1st, 1878.

T GAINFORD,

DURHAM.

Longitude 1° 44' 15" W.

ound, 1 Ft. Height above Sea Level, 250 Feet.

877 inclusive.

JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	Total Inches
220	0·790	3·070	5·120	1·710	2·530	5·470	26·130
010	0·450	1·450	3·890	1·920	2·700	3·520	26·750
610	0·570	2·360	0·810	5·100	1·450	3·700	21·620
200	3·110	1·250	5·520	1·980	1·220	1·870	25·970
990	5·150	3·900	3·320	4·160	4·410	3·340	41·010
330	3·300	2·090	1·440	2·120	2·070	0·390	20·610
410	2·470	3·160	2·560	1·960	2·130	3·700	25·980
980	4·290	2·400	3·170	4·370	5·790	1·920	30·250
430	2·140	2·200	3·845	1·690	3·135	7·210	31·560
300	3·610	4·995	2·175	2·805	2·710	1·550	33·530
748	2·588	2·687	3·185	2·781	2·814	3·261	28·341

by the least in 1873—20·610; averaging 30·810.

succeeded by the two exceptional years, 1872-3.

FALL FOR TEN YEARS.

Third Quarter, 8·460.

Fourth Quarter, 8·856.

ls in each Quarter for Ten Years.

				INCHES.	
Jan.	1876	..	..	0·305	Minimum.
June	1868	..	..	0·220	„
July	1869	..	..	0·450	„
Dec.	1873	..	..	0·390	„

A. ATKINSON.

moderately, in N.E. and E. As much as 1·89 in. fell in this storm, of which, incredible as it may seem, I am sure that far the larger portion came down in ten minutes.

As far as I can learn, but little hail fell at any of the neighbouring villages, from two to three miles distant in several directions.

The barometer fell steadily, and I could not see that the mercury was affected by the down-rush of water.

Thunder was again frequent towards Birmingham at 9 a.m., and at 9.50 another thunderstorm passed over us from S.W. by S. to N.E. by N., but without hail.

A hail, or rather sleet, squall occurred on the morning of the 21st, and from noon to 0.50 p.m. we had a heavy thunderstorm from the N.W., during which much hail fell, but it was small and sleety.

On the 24th, at 2 p.m., we had again a thunderstorm, with hail, during a shift of wind from S.W. to N.N.E. As far as I can discover, this storm was rather local, and was heavier here and immediately to the S.E. of this place than elsewhere.

At 8 a.m. of the 25th a slight hail-shower passed over from N.W. At 10 a.m. a very violent thunderstorm broke over us from the same quarter, the hail, which was large and hard, completely covering the ground. At 11 we had again a violent hailstorm, but without thunder. In a shady situation I gathered handfuls of ice at sunset of that day.

At noon of the 28th a slight thunderstorm passed over us from E.S.E. ; but no hail fell in this storm.

Since the 25th we have had no hail. But at 4.30 p.m. of the 31st an exceedingly black cloud passed over, from which hung a fine water-spout, reaching, as I should judge, about half way from the cloud to the earth's surface, and distant between one and a half and two miles to the S.W. of this place. From the time I first saw it, it lasted about 10 minutes. The spiral motion in this spout was *with* watch-hands. No thunder occurred, and only a few drops of rain fell. The atmosphere was very calm, both on the earth and in the cloud. Electricity strongly negative.—Yours truly,

W. CLEMENT LEY.

Ashby Parva, Lutterworth, June 6th, 1878.

NATURAL HISTORY NOTES FOR 1877.

[Among the notes supplied by contributors to *British Rainfall* are many not bearing strictly upon that subject. I have, therefore, thought it better to group together the following and to insert them in these pages.—Ed.]

JANUARY.

19th.—*Diss* (IV). On this day I gathered a quantity of wild prim-roses, about 10 days earlier than I recollect to have seen them before.

21st.—*Warbledon Rectory* (II). Saw a butterfly about 2.30 p.m.

FEBRUARY.

- 11th.—*Addiscombe* (II). Almond trees in blossom.
 14th.—*Stanley* (IX). Blackbird in song.
 17th.—*Swallowfield* (II). Gathered some palm in full flower.
 18th.—*Addiscombe* (II). Elm trees in full blossom.
 20th.—*Addiscombe* (II). Iris reticulata in blossom in the garden,
 according to *Gardener's Magazine*, two months before its usual time.
 22nd.—*Harrow* (I). Apricots in blossom.

MARCH.

- 4th.—*Stanley* (IX). Robins building.
 20th.—*St. Lawrence* (II). Blackthorn in full bloom.
 30th.—*Stanley* (IX). Swallow arrived here.

APRIL.

- 2nd.—*Addiscombe* (II). Gooseberries and currants in blossom.
 4th.—*St. Lawrence* (II). Wryneck heard.—*Alderbury* (V). Wryneck heard.
 6th.—*Swallowfield* (II). Saw the first swallow.
 8th.—*Pinner Hill* (I). Swallow seen.—*Alderbury* (V). Nightingale seen on lawn.
 13th.—*Littlehampton* (II). Nightingale heard.
 14th.—*Littlehampton* (II). Swallow seen.
 17th.—*St. Lawrence* (II). Nightingale heard.
 19th.—*Pinner Hill* (I). Cuckoo heard.—*Cambridge* (III). Nightingale arrived.
 20th.—*Swallowfield* (II). Heard the cuckoo.
 21st to 24th.—*Addington* (III). Our summer visitors late in coming, cuckoo, swallows and nightingale all appearing during this time.
 22nd.—*Harrow* (I). Martins, cuckoo and swallows seen.—*Bristol* (VI). Swallow first seen.
 24th.—*Bristol* (VI). Cuckoo heard.
 27th.—*St. Lawrence* (II). Cuckoo heard.
 28th.—*St. Lawrence* (II). Lilac in bloom ; first dish of asparagus.
 30th.—*Harrow* (I). Swallows and fieldfares seen.

MAY.

- 11th.—*St. Lawrence* (II). First swarm of bees.
 15th.—*Addiscombe* (II). Persian lilac in bloom in garden.
 19th.—*Addington* (III). Swifts first seen.
 21st.—*St. Lawrence* (II). First swift seen.
 22nd.—*St. Lawrence* (II). First globe artichoke.
 26th.—*Addiscombe* (II). Strawberry, hawthorn and laburnum in blossom.
 29th.—*Addiscombe* (II). Rhododendrons in blossom.
 31st.—*East Layton* (X). Cuckoo heard.

JUNE.

5th.—*Stanley* (IX). Swifts hawking.
 12th.—*Diss* (IV). First wild rose.
 14th.—*St. Lawrence* (II). First dish of peas. Strawberries.
 16th.—*Stanley* (IX). Hawkweed in flower.
 19th.—*St. Lawrence* (II). Carted hay.
 20th.—*Addington* (III). Haymaking general.
 21st.—*Stanley* (IX). Rain in night; corn shot; haymaking begun.
 30th.—*Addiscombe* (II). Picked the first ripe strawberries on bank facing the N.—*Ilslington* (V). Hay harvest well secured.—*Church Stretton* (VI). The cuckoo sang throughout the last days of June, also on July 1st—a circumstance I never heard of before in this part of the country.

JULY.

11th.—*Partney* (VII). Cuckoo singing frequently.
 14th.—*Stanley* (IX). Corn laid by the gale, but recovered its upright position by the 23rd.

AUGUST.

11th.—*Diss* (IV). First wheat cut.
 14th.—*Addington* (III). I observed several specimens of the clouded yellow butterfly during the latter part of the month, which is very rare in this district, so much so, that I have only seen three specimens previously during twenty-three years.—*Diss* (IV). Harvest general.

SEPTEMBER.

15th.—*Diss* (IV). Harvest over.
 23rd.—*St. Lawrence* (II). The clouded yellow butterfly, “*Edusa*,” has been most abundant this autumn, and I have also seen many pale clouded yellow “*Hyale*.”—*Addington* (III). Observed a crow building a nest.
Ilslington (V). Corn harvest saved in first-rate condition, and good yield.—*Blencowe* (X). Corn harvest turned out well, plentiful and fairly housed; but the hay harvest was decidedly the most tedious on record, large plots of good hay never cleared at all. Potatoes small and much diseased; turnips the most signal failure of the year.—*Woodlands, Elterwater* (X). The foliage and brackens are very slow in assuming their autumnal colouring; very few nuts or blackberries have ripened this year for want of sun.—*Fort William Public School* (X). The harvest was not very unfavourable owing to dry weather in the latter part of September and beginning of October.

OCTOBER.

21st.—*Addington* (III). Swallows about in numbers.
 26th.—*Stanley Vicarage* (IX). Thrushes singing.

NOVEMBER.

13th.—*Swallowfield* (II). Sulphur butterfly seen.

14th.—*St. Lawrence* (II). Flight of swallows seen—*East Layton* (X). Roses in bloom.

15th.—*East Layton* (X). Polyanthus coming into bloom.

29th.—*East Layton* (X). Passion flower in bloom in open air.

DECEMBER.

1st.—*Brookwood, Hollington* (II).—Gathered a dish of green peas, and a bouquet of 30 kinds of flowers in open garden.

12th.—*Brampford Speke* (V). Ripe, well-flavoured, wild hedge strawberry gathered. Many wild flowers open then and afterwards.

24th.—*Brookwood, Hollington* (II). Gathered 15 kinds of flowers in garden.—*Week St. Mary* (V). Gathered wild strawberry ripe.—*Islington* (V). Fuchsias, hydrangeas, &c., almost in full bloom out of doors on Christmas Day.

THE WEATHER IN MAY.

THE distribution of pressure at the beginning of the month was much the same as at the close of April, and no important change took place until the 5th, when a well-marked depression lay over the Baltic; an area of high pressure lay over England, the north of France, the Netherlands, and N. Germany. The decrease over these Islands and France continued through the next day, when a large depression was shown on our S. W. coasts, moving in a N. N. W. direction. Pressure was decreasing over the North Sea, but was increasing elsewhere. A band of low readings (29·7 in.) lay over these Islands, whence pressure rose to 30·2 in. in the Gulf of Bothnia, and to 29·8 in. in the S. W. of France. The wind consequently varied between S. W. and N. W. in the south, and between N. E. and E. in the north. During this day (7th) a large shallow depression appeared in the S. E., but the relative distribution of pressure remained much the same.

On the 9th the barometer rose everywhere, except in the S. W. of these Islands, and the distribution of pressure had altered somewhat from the previous day; a large area of comparatively high readings (30·0 in.) lay over the North Sea, Denmark, and the S. of Norway, while a depression in which the lowest readings were 29·6 in. lay off the S. W. of Ireland. The sky was cloudy, except in Scotland, Denmark, and some parts of France. During the day the depression moved N. W., and the barometer rose in the S. and W., but fell slightly in the N.

On the 11th, a rather large disturbance lay to the westward of Ireland, while a small subsidiary depression was shown over S. Wales, and the wind on our western coasts increased to a moderate or fresh gale. The barometer continued to fall, and on the 12th pressure was in a very unsettled state; it was increasing a little in the S., and decreasing in the N.; the highest readings (30·1 in.) lay in the south of Sweden; the lowest (29·3 in.) off the west of Ireland; gradients were rather steep on our western coasts.

The barometer fell everywhere except the extreme S. of France on the 14th; a large area of low pressure lay off our western coasts, while a small local depression was shown near Paris. Readings were high both over the Baltic and the Mediterranean. On the 16th the mercury rose over all Western Europe, briskly over these Islands and France, less so over Scandinavia; in the latter part of the day the bar. fell very quickly in the N. of Ireland, while it still rose slightly in the S. E.; in consequence, gradients increased somewhat, and the S. wind blew stronger. The mercury continued to rise in the N., and on the morning of the 18th the change was more than half-an-inch, but in the S. and over France it was falling: a depression lay over the N. coast of Ireland in the morning, but by 6 p. m. it had advanced to the Hebrides, and there were indications of a fresh disturbance in the S. W. At Valentia a moderate S. S. W. gale took place.

After this the weather continued very unsettled, and numerous depressions passed over Western Europe. At first they passed across the N. part, but on the 23rd a deep disturbance advanced from Ireland and passed eastward across the S. part of Great Britain. An anti-cyclone (30·1 in.) lay over the Bay of Biscay and the W. of France, while a large area of low pressure, with its centre near Hernösand (29·48 in.) was shown over Scandinavia. On the 24th the depression, moving eastward, gradually left our coasts, but the recovery in its rear was not very decided; the N.W. wind rose to a gale at the mouth of the Channel.

On the 26th the barometer rose in nearly all parts of Western Europe, but was rather unsteady in the south of Ireland. On the 30th a very shallow depression reached the W. of France, travelling in an easterly direction. The weather was clear and bright in N.W. Europe, and continued so on the 31st. H.E.M.

SUPPLEMENTARY TABLE OF RAINFALL IN MAY, 1878.

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

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	3·37	XI.	Solva	2·58
„	Littlehampton	3·56	„	Castle Malgwyn	4·49
„	Hailsham	3·94	„	Nantgwilt, Rhayader	6·83
„	St. Lawrence, I. of W....	2·77	„	Carno	5·51
„	Strathfield Turgiss	2·57	„	Rhug, Corwen	4·42
III.	Addington Manor	4·89	„	Port Madoc	3·92
„	Oxford	5·08	XII.	Carsphairn .....	...
„	Northampton	4·06	„	Melrose	4·66
„	Cambridge	3·60	XV.	Gruinart	2·52
IV.	Sheering	4·64	XVI.	Grandtully .....	...
„	Diss	4·69	XVII.	Tomintoul	1·98
„	Swaffham	4·22	„	Keith	3·24
V.	Alderbury, Salisbury ...	4·16	XVIII.	Dalwhinnie	4·00
„	Compton Bassett	4·43	„	Auchnasheen	4·42
„	Dartmoor	8·85	„	Springfield, Tain	2·92
„	Teignmouth	4·83	„	Glenfinnan	6·83
„	Langtree, Torrington ...	7·54	XIX.	Watten	1·61
„	Cosgarne, St. Austell ...	5·53	XX.	Glenville, Fermoy	6·19
„	Taunton	3·96	„	Tralee	4·91
VI.	Bristol	6·20	„	Tipperary	4·73
„	Sansaw	4·38	„	Newcastle W., Limerick ..	4·02
„	Cheadle	4·70	„	Kilrush	2·81
„	Bickenhill Vicarage	5·95	XXI.	Kilkenny	3·91
VII.	Coston, Melton Mowbray ..	3·76	„	Kilsallaghan	4·87
„	Bucknall	4·00	„	Twyford, Athlone	3·99
VIII.	Walton, Liverpool	3·39	„	Belvedere, Mullingar ..	4·67
„	Broughton-in-Furness ..	4·15	XXII.	Ballinasloe	4·36
IX.	Stanley, Wakefield	4·12	„	Kylemore	6·33
„	Mickley, Ripon	5·74	„	Carrick on Shannon	4·47
„	Whitby .....	...	XXIII.	Rockcorry	4·50
X.	Gainford	4·08	„	Warrenpoint	5·87
„	Unthank Hall	4·35	„	Newtownards	4·20
„	Shap	5·62	„	Bushmills	3·06
IX.	Llanfrechfa	6·81	„	Buncrana	3·96

MAY, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which -01 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.			Deg.	Date.	Deg.	Date.		
												In shade	On grass.
I.	Camden Town	inches 3·89	inches. + 1·49	in. 1·71	7	19	74·9	18	36·7	21	0	0	
II.	Maidstone (Hunton Court)...	3·66	+ 1·42	·58	28	20	...	...	...	...	...	...
III.	Selborne (The Wakes).....	4·97	+ 2·49	·85	16	21	68·0	11	35·0	5	0	0	
IV.	Hitchin	4·69	+ 2·76	1·05	7	23	67·0	2	35·0	20	0	...	
V.	Banbury	5·11	+ 2·89	1·01	7	25	69·5	18	35·0	31	0	...	
VI.	Bury St. Edmunds (Culford)...	4·73	+ 2·57	1·56	7	23	74·0	2†	35·0	20	0	2	
VII.	Norwich (Sprowston).....	...	...	...	...	...	...	...	...	...	...	...
VIII.	Bridport	6·10	+ 4·07	1·96	10	18	...	...	...	...	...	...
IX.	Barnstaple.....	4·82	+ 2·38	·83	13	23	70·0	11†	41·0	24	0	...	
X.	Bodmin	6·87	+ 4·41	1·30	10	25	66·0	18	41·0	5	0	0	
XI.	Cirencester	4·64	+ 2·36	·83	16	27	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall) ...	5·95	+ 3·69	1·08	10	26	67·0	1	36·0	21	0	0	
XIII.	Tenbury (Orleton)	6·12	+ 3·24	1·23	10	25	68·0	18	33·8	21	0	1	
XIV.	Leicester (Town Museum) ...	4·71	...	1·14	7	25	69·5	18	36·9	21	0	3	
XV.	Boston	4·00	+ 3·06	·66	8	24	76·0	12	35·0	21	0	...	
XVI.	Grimsby (Killingholme)	2·25	...	·45	7	21	67·0	12||	36·0	21	0	...	
XVII.	Mansfield	4·87	...	·55	8	23	70·2	5	35·8	21	0	0	
XVIII.	Manchester (Ardwick).....	3·43	+ 1·05	·35	29	27	76·0	6	38·0	21	0	...	
XIX.	York	3·55	+ 1·60	·47	14	18	71·0	6	34·5	21	0	...	
XX.	Skipton (Arncliffe)	6·47	+ 3·12	·95	15	22	73·0	5	31·0	20	...	...
XXI.	North Shields	1·89	— ·75	·40	7, 18	16	...	...	...	...	...	...
XXII.	Borrowdale (Seathwaite).....	9·30	— ·24	1·06	18	22	...	...	...	...	...	...
XXIII.	Cardiff (Crockherbtown).....	4·32	...	·71	16	24	68·2	31	38·1	21	0	...	
XXIV.	Haverfordwest	5·38	+ 2·66	1·30	10	19	65·0	10§	36·0	20	0	2	
XXV.	Aberdovey.....	3·99	...	·61	10	20	78·0	29	42·0	21	0	...	
XXVI.	Llandudno.....	2·45	+ ·07	·31	27	22	71·0	12	39·6	21	0	...	
XXVII.	Dumfries (Crichton Asylum)...	4·85	+ 2·42	1·21	28	21	68·2	7	35·0	21	0	0	
XXVIII.	Hawick (Silverbut Hall).....	3·91	...	·54	7	19	...	...	...	...	...	...
XXIX.	Glasgow (Cessnock Park) ...	2·90	+ ·52	·58	14	24	...	...	...	...	...	...
XXX.	Mull (Quinish)	2·25	...	·57	16	19	...	...	...	...	...	...
XXXI.	Loch Leven	4·70	+ 2·50	·80	8	16	...	...	...	...	...	...
XXXII.	Tyndrum (Ewick)	6·20	...	...	...	...	...	...	...	...	...	...
XXXIII.	Arbroath	1·88	— ·10	·46	19	15	64·0	17¶	35·0	20	0	...	
XXXIV.	Braemar	2·30	+ ·50	·44	19	13	67·2	5	26·0	10	2	11	
XXXV.	Aberdeen	2·13	...	·47	21	15	65·2	16	37·7	21	0	2	
XXXVI.	Gairloch	3·38	...	·49	21	19	...	...	...	...	...	...
XXXVII.	Portree	3·50	— 2·15	·79	3	18	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	1·62	— ·06	...	...	18	69·4	6	33·4	9	0	8
XXXIX.	Dunrobin	2·75	+ 1·30	·81	19	15	65·5	5	34·5	21	0	...	
XL.	Sandwick	2·91	+ ·65	·69	27	18	60·4	15	33·9	21	0	1	
XLI.	Caherciveen Darrynane Abbey	4·50	...	·41	14	24	...	...	...	...	...	...
XLII.	Cork	5·68	...	·72	17	21	...	...	...	...	...	...
XLIII.	Waterford	4·81	+ 2·56	·74	10	22	64·0	1, 29	38·0	21	0	...	
XLIV.	Killaloe	4·48	+ 1·30	·97	13	23	74·0	29	35·0	21	0	...	
XLV.	Portllington	4·45	+ 1·25	·88	10	26	66·0	17	40·0	20	0	...	
XLVI.	Monkstown, Dublin	5·03	+ 3·12	·80	10	21	75·0	29	33·0	22	0	...	
XLVII.	Galway	3·36	...	·59	11	21	65·0	6**	41·0	30	0	...	
XLVIII.	Waringstown	3·91	...	·40	14	22	70·0	1, 4	36·0	21 †	0	...	
XLIX.	Edenfel (Omagh)	4·02	...	·50	14	23	66·0	5	35·0	29	0	0	
L.	Ballyshannon	4·01	...	·54	15*	22	...	...	...	...	...	...

* And 22.

† And 12, 17, 18.

‡ And 18, 19.

§ And 18.

¶ And 11.

¶ And 30.

** And 11, 12, 29, 30.

†† And 31.

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

METEOROLOGICAL NOTES ON MAY.

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.—The beginning of the month particularly favourable both for gardens and the cereal crops, but the continuous wet afterwards led to much misgiving as to the wheat and barley. T and L all the night of the 16th, and a violent H storm in the morning of 17th, not lasting more than five minutes, nor extending more than about a mile in either direction. The hailstones were as large as marbles.

BANBURY.—H on 20th, 21st, and 25th; TS at 3 a.m. on 18th, tree struck; T and L on 10th and 25th, L on 1st, T on 2nd and 28th.

CULFORD.—Rainfall considerably above the average; mean temp. 56°, which is also above the average. Considerable electrical disturbance during the latter half of the month; Polar winds prevailed on 14 days; T showers on 1st, 17th, 18th, and 25th; TS on 21st, 24th, 26th, 27th, and 28th; H on 21st and 25th; high wind on 16th and 19th.

BODMIN.—Mean temp. 56°·6.

SHIFNAL.—The wettest May here for 44 years at least, nearest approach in 1869 when 4·73 in. fell. Also the wettest month in that period, with the exception of November, 1852 (6·59 in.). R daily till 29th with two exceptions (4th and 5th); T on 1st, 14th, 27th, and 28th. Wonderful growth of vegetation till 21st, when it was checked by sudden cold. Meadows flooded, farmers unable to get in their swedes, &c. Apple in blossom on 3rd; hawthorn on 12th; oak in leaf on 7th; ash very late; swifts arrived on 9th, flycatcher on 19th. Transit of Mercury on 6th, obscured by dense cloud.

LEICESTER.—T and L between 7 and 8 p.m. on 1st; heavy R on 7th; T L H and S on 14th; H on 15th; TS on 18th; T and gale on 21st.

BOSTON.—The heavy rains did not cause any floods or damage to the crops in this immediate neighbourhood, but on the Welland both Cowbit and Crowland washes have been flooded to the depth of about 4 feet. The hay crops, and where the land has been broken up, crops of mustard and barley, will be seriously damaged by the sediment from the water. The rainfall is the heaviest recorded in this district in May, the next being 3·86 in. in 1869, and 3·48 in. in 1860. Several TSS during the month. May in flower about the 11th; lilac and laburnum about the 18th; spring flowers and foliage very luxuriant.

KILLINGHOLME.—Though R occurred on 21 days, no great weight fell. Sunshine was deficient, but crops of all kinds are very promising. Remarkably few of our migratory birds have arrived. T on 1st, 2nd, 12th, 14th, 18th, and 28th; L on 14th and 18th; H on 14th.

MANSFIELD.—TS on 1st; continuous R all day on 8th; heavy TS with H between noon and 1 p.m. on 18th.

MANCHESTER.—The month opened with genial weather and refreshing showers, which promoted vegetation rapidly, but unfortunately instead of clearing up, the weather continued dull and showery through the whole month, and although the rainfall was not heavy, it left the impression of a very wet, cold month. Cold E. wind prevailed in the early part; T on 1st and 11th.

ARNCLIFFE.—Village green white with S at 4 a.m. on 20th.

NORTH SHIELDS.—TS on 12th, 14th, 15th, 18th and 26th.

WALES.

HAVERFORDWEST.—Night temperatures much above the average for May. The wettest May during the last 29 years, with the exception of 1869, when 5·69 in. fell. The TS of the 10th and 11th was very severe, it ushered in a very chilly wet period; for 16 days R fell uninterruptedly. Oak in full leaf, but ash very backward; vegetation very advanced; the corn has suffered in some districts from the incessant cold R.

ABERDOVEY.—A wet month, generally cloudy, with frequent showers; T on 18th.

LLANDUDNO.—Though there were a considerable number of very fine days, the month was on the whole cold, the mean temp. being no less than $5^{\circ}\cdot5$ below that of last May, and about 3° below the average. There was no frost, but we had a cold wave on the 8th and 9th, and another of more extended range from the 19th to the 25th. All crops in this neighbourhood are looking well, fruit included. The rainfall was pretty equally distributed from the 6th to the 27th; H and S on 21st; laburnum in bloom on 1st, hawthorn on 4th, lilac on 6th, horse chestnut on 10th, mountain ash on 19th, elder on 20th, hedge roses on 30th, common poplar in leaf on 13th, swifts seen on 3rd, ten days earlier than last year.

SCOTLAND.

DUMFRIES.—A mild moist month, rainfall and temp. being considerably above the average; T and L on four days; winds generally moderate; mean height of bar. below average.

HAWICK.—Rainfall more than double the average; prevailing winds, easterly; hills white with S on 19th and 20th; slight touch of frost on night of 19th; T on 12th, 13th, and 28th; hay-crop early and will bulk largely; gooseberries a very irregular crop; red, white, and black currants very promising; apple-trees literally covered with blossom.

BRAEMAR.—A month of fine seasonable weather; T on 18th, 27th, and 28th.

ABERDEEN.—A month of rather dull weather, but on the whole, fine; rainfall a little above the average; temp. about the mean, or a little above; T and L on 16th and 26th, S and sleet on 20th; H on 21st.

PORTREE.—A very fine month; enough moisture for vegetation, but not enough to hinder agricultural operations; S on hilltops, 20th to 23rd inclusive; a fine meteor from S.E. to S.W. at 10 p.m. on 7th.

DUNROBIN.—The month was uncommonly favourable for bringing forward all kinds of vegetation. The S and sleet, and rather low temperature, towards the end, checked growth somewhat, but about here seems to have done no great harm. T and L on 13th.

SANDWICK.—The S.E. wind that was so persistent during April, prevailed generally till the 19th, and from that time the N. winds have kept the air cold, a hill 1,500 feet high being covered with S on 20th and 21st; aurora to zenith on 14th.

IRELAND.

DARRYNANE.—If there be any truth in the old saw :—

“A wet and windy May

Fills the haggart* with corn and hay”—

the harvest of this year should be good, for the past month was very wet and stormy. Wind very variable early in month, but from 13th to 26th was very fresh from S.W. and N.W. The wettest May of the last nine years; last four days very fine and summer-like.

KILLALOE.—Entire absence of frost, with abundance of R, and mean temp. above the average, have promoted early and forward vegetation; agricultural prospects good.

MONKSTOWN.—A month of almost continuous R, nearly half the total fall for the past five months being registered in it. The last four days were extremely fine, with E. winds.

WARINGTOWN.—Very favourable; crops most promising; last four days a little cold.

ENNEL.—A rainy, humid month, without frost, and highly favourable for vegetation, which has never been more forward and luxuriant at this season.

BALLYSHANNON.—The month, though more than usually wet, has been a favourable one for the growth of crops, all of which are promising well. There was slight frost on several nights, which damaged the fruit trees. Rainfall 1·35 in. more than corresponding period in 1877.

* Stack yard.

6



SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXLX.]

JULY, 1878.

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THE JUNE THUNDERSTORMS.

IF three or four inches of rain, or even a waterspout delivering almost as many feet, falls on a mountain side it makes havoc of an acre or two of ground, and swells the nearest brook into a torrent; if there happens to be a mill upon the stream, it washes it away, and then reaching a river it puts it in slight temporary flood, and all is over. A paragraph of a dozen lines reports the "Bursting of a Waterspout," and in a week the whole is forgotten, except by the miller and his friends and the farmers in the neighbourhood. But if anything like such an occurrence takes place over a thickly peopled district, there is as much disturbance and commotion as when a jug of water is poured upon an ant-hill.

We have for years been urging that rainfall observers should be prepared for falls of at least four inches. We may as well quote the rules upon this subject:—

"XVI.—OVERFLOW.—It would seem needless to caution observers on this head, but as a recent foreign table contains *six instances on one day* in which gauges were allowed to run over, it is evidently necessary that British observers should be on the alert. It is not desirable to purchase any new gauge of which the capacity is less than four inches."

"XVII.—SECOND GAUGES.—It is desirable that observers should have two gauges, and that one of them should be capable of holding eight inches of rain."

If our readers will turn to Table II. p. [87] of *British Rainfall, 1877*, they will find that during the past thirteen years there is not one in which the fall has not exceeded four inches at one or more stations.

These heavy falls are usually over a very small area, and rarely occur twice in the same neighbourhood. In fact, until the March meeting of the Meteorological Society, when, in a paper upon Waterspouts, it was stated that a hill in the North of Ireland was called the "Hill of the Waterspouts," owing to the frequency of their bursting there, we had no idea that two ever went in the same direction. We have not had a waterspout in North London—there would have been terrible ruin if we had—but two falls, each exceeding three inches in 24 hours, and one exceeding three inches in less than 2 hours, and the result has been very considerable loss.

As with heavy rain so with lightning. Had the slopes south of Hampstead and Highgate remained in the condition in which they were a hundred years ago, the only traces of the lightning of June 23rd would have been slight damage to two or three trees and perhaps a few burnt patches on the grass. But man covers the fields with houses, provides these houses with chimneys, lights fires at the bottom of them, sends currents of heated air and smoke out at the top, puts up no lightning conductor, and is surprised if the lightning avails itself of the path which he has thus provided for it, but to which the only outlet is a rush across the kitchen to the general dismay of the whole household.

We must proceed from generalities to particulars; but it is very difficult to condense the latter sufficiently.

On June 16th there was thunder in the west of London from 1.40 to 2.40 p.m.

On June 23rd thunder was first heard at Camden Square at 0.52 p.m.; lightning was first seen at 1.3 p.m. in S.E., distance (as determined by Redier's telemeter) 2.9 miles. About 1.20 p.m. the air began to thicken as if with fog, and objects 2 miles, 1 mile, $\frac{1}{2}$ mile, and $\frac{1}{4}$ mile distant were successively obscured. At 1.32 it began to rain, at 1.40 it became heavy, and from 1.44 to 2.12 (or in 28 minutes) 2.32 in. of rain fell. There was a cessation of rain from 2.12 to 2.46 p.m., after which a second very heavy fall occurred, 0.86 in. falling in 16 minutes. By means of Pastorelli's storm gauge these remarkable rains were read off every half-minute, and the full records will be given in *British Rainfall*, 1878, but it may be mentioned that one-tenth of an inch fell in the 30 seconds between 2.4 and 2.4.30 p.m., and an inch in the ten minutes between 1.57 and 2.7 p.m.

The total fall in exactly an hour and a half was 3.28 in., but as no rain fell between 2.12 and 2.46, *the whole 3.28 in. fell in four minutes less than an hour.*

The extremely local character of the fall is shown by the following table, and also by the map accompanying this number. From Haverstock Hill to Camden Square is exactly a mile; the fall at the former was 0.56 in., at the latter 3.28 in.

	in.		in.
Eltham Green.....	.24	Hampstead, South Hill Park ...	.38
Kew Observatory .....	.00	„ Squires Mount .....	.33
Greenwich Observatory.....	.61	„ Branch Hill .....	.32
Westminster, Spring Gardens ...	.07	Upper Clapton, The Common ...	.96
Guildhall.....	.31	Child's Hill, Helenslea.....	.06
Clerkenwell, New River Head...	.31	Highgate Nurseries .....	.40
Regent's Park, Botanic Gardens.	.76	Tottenham, Grove House .....	.98
Hamilton Terrace, N.W. ....	.34	Hornsey	1.32
Camden Square, N.W.	3.28	Muswell Hill .....	.04
235, Camden Road, N.	2.73	Colney Hatch.....	.00
277, „ „ N.	2.65	Southgate, The Lawns .....	.00
Hackney, Richmond Road	1.02	Winchmore Hill.....	.01
Haverstock Hill.....	.56	Enfield Chase .....	.00
Hampstead, Roslyn House .....	.34		

The following letter by Mr. W. P. Swainson gives such an accurate description of the phenomena in the vicinity of Camden Road that we insert it here, so as to avoid repetition :—

To the Editor of the Meteorological Magazine.

SIR,—The following particulars of the above storm may interest your readers, it doubtless being one of the most severe upon record. Thunder was first heard here about 0.45 p.m., and continued, though at a distance, till 1.34, when it commenced to rain. At 1.44 it began to pour a perfect deluge, and continued till 2.15, when it ceased, the gauge showing that 2.03 in. had fallen in forty-one minutes. The lightning during the first part of the downpour was terrific, flash after flash of forked lightning being followed by loud peals of thunder, in many cases instantly. Thunder and lightning continued more or less from 2.15 to 2.40, when a second fall of rain began, which finished at 3.18, at times pouring in torrents, accompanied by large hailstones, the rain-gauge yielding .62 in. during this second storm, making a total of 2.65 in. The lightning was very vivid, and the thunder loud and crackling during the downpour. The thermometer at 9 a.m. stood at $71^{\circ}4$; it reached a maximum of $73^{\circ}6$ during the morning; at 1 p.m. it was 73° ; at 1.20, $70^{\circ}5$; after which it fell rapidly, and sometime between 1.33 and 2.15, during the first storm, showed a minimum of $57^{\circ}7$. At 2.16 it marked $60^{\circ}3$, but during the second storm it fell again and gave a minimum of $56^{\circ}6$ between 2.40 and 3.18.

The distant thunder which was heard here before and shortly after 1.0 p.m. appears to have been a storm which passed away to the S.E. of this station. The first storm we had came up from the S.S.W. of this station, and meeting another coming from the N.N.E., burst immediately over this district, causing the immense downpour of rain here. It finally seems to have passed away to the N.N.E., where it must have spent itself. The second storm apparently came from the S.W., and passing overhead travelled away in a northerly direction.

The wind just before the storm was S.E., and during the storm was from all points of the compass.

A curious fact about the storm was that a dense atmosphere, not unlike a November fog, gradually enclosed us just before the rain commenced.

The following is a list of the places struck by lightning in the immediate neighbourhood, as far as I have been able to ascertain :—

No. 13, Murray Street, Camden Town, had the kitchen chimney struck, the bricks falling into the yard at the back.

The lightning severely damaged Nos. 68 and 70, St. Augustine's Road, striking one of the chimneys and passing down it till it reached the drawing-room of No. 68, when it reascended, crossed the top room, and passed out of the staircase window, which happened to be open. At No. 70 it broke the bell wires, and made two holes in the gas pipes.

A flash of lightning struck the chimney of the London Pianoforte Company, Castle Road, Kentish Town, knocking off several pieces, weighing in all considerably over 40 lbs., one piece alone being $14\frac{3}{4}$ lbs.

One of the chimneys at No. 189, Camden Road was struck, filling the grate of the room with *débris*. Four bricks fell into the back garden of No. 187, and three quarters of a brick into the front; $1\frac{1}{2}$ bricks fell into the garden at 189, also a broken slate and $\frac{1}{2}$ -brick fell on the leads. I may mention that the Imperial Insurance Co., though not responsible as there were no signs of fire in the house, put it right at once.

Nos. 7 and 8, Hartham Road were struck; the servant at No. 7 saw the lightning come down the kitchen chimney, accompanied by a report like firing a pistol, after which a piece of iron was picked up, which had come down the chimney. The piece of iron is of irregular shape, $\frac{3}{4}$ of an inch in its longest diameter, and has evidently been fused; it weighs about 90 grains. At No. 8 the soot was driven down the chimney, covering the kitchen, and a baby that was in it.

The electric fluid struck Nos. 2 and 3, Hilldrop Road, doing much damage. The kitchen chimney of No. 2 was smashed to atoms and the bricks were scattered over the garden. Soot was sent down the chimney and the dinner, which was cooking, spoilt. At No. 3 the lightning struck the kitchen chimney, knocking out at least a dozen bricks and sending them over the garden. Part of the flash seems to have gone down the chimney and set it on fire, and the other part ran along the iron gutter, twisted it up, and finished its career by passing down the rain-water pipe, taking a piece out at every joint. The side roof was damaged so much that the rain came through.

Nos. 410 and 412, Camden Road were considerably damaged, the low brick chimney between the two houses being struck and the brick-work partly cut away, the high metallic chimney next to it escaping. Many slates were knocked off both roofs, which were so much damaged that workmen had to be fetched the same Sunday afternoon to repair them. The bricks were thrown over the two houses, some being sent to the far end of the back garden, while the front garden was covered with *débris*. The floor of the kitchen of No. 410 was covered with soot, and a leg of mutton which was cooking was completely spoiled.

The chimney at Beau Séjour, Carleton Road, Tufnell Park, was struck and cut in two, the bricks falling into the next garden.

The awning over the stable at the back of Topfield House, Tufnell Park was cut into pieces, the pole split, and the wirework blackened.

The house at the corner of Tollington and Annette Roads, Holloway, was struck, the roof and the ceilings of two rooms being damaged.

A flash of lightning is reported to have been seen to strike the road-way near the junction of Seven Sisters Road and Holloway Road.

It will be seen that the places struck completely environ this station, also they are within a very short distance of each other, showing the severity of the storm in this neighbourhood. The above instances

show 10 distinct flashes of lightning striking houses. There were doubtless others of which I have not heard.

The following instances will give some idea of the damage done by the rain :—

This house, though at the top of the hill, and 160 feet above sea level, had water in the scullery and passage, while the stable in the garden had (through the rain stopping up the drain) no less a depth of water in it than 16 inches, and in some parts 22½ inches. Almost every house had more or less water in the basement, some having between one and two feet.

The worst damage done by the rain seems to have been at Nos. 12, 14 and 16, Carleton Road, Tufnell Park, where the water rushed down the fields, and the drain not being sufficient to carry it off, knocked down the garden wall of No. 16, carrying it away completely and filling the basement of the house with water, bricks and other *débris* to a depth exceeding 4 feet. It then did the same with the garden wall and basement of No. 14, and finally washed down the wall of No. 12, suddenly bursting open a strong wooden door, barricaded with rolled carpets, and rushing into the basement like a river filled it to a depth of over 4 feet. One of the servants, seeing what was coming, jumped through the window and escaped, while a second jumped on to the dresser and hung on to the top of the kitchen door. A lady, who happened to be in the kitchen at the time, was with difficulty got out by the gentleman through the water. The basement was filled with bricks and *débris*, the piano overturned and wrecked, the billiard table spoilt, and chairs, tables and heavy furniture turned over and completely wrecked. The shutters were forced up by the rush of water, and even a full cask of beer was floated on the top of the coals. When the storm ceased, a fire engine had to be sent for to pump the water out. Six gentlemen assisted to clear out the mess in the basement, which was not got straight till 12 o'clock at night. Nos. 14 and 16 were in much the same state. No. 5, Carleton Road had the basement filled all over to a depth of 16 inches, by my own measurement, and many other houses were in a similar condition. The water in the Holloway Road was more than 4 feet deep, it being above the top of the wall opposite Lorraine Place, coming up to the horses' collars and going through the trams and 'busses. The "Constitution Tavern," Camden Town, had from 6 ft. 4 in. to 7 ft. of water in the basement, the casks of beer floating right away. I may as well mention that I personally called at all the above-named places in order to ascertain exactly what was the damage done by the storm.

Yours truly,

W. P. SWAINSON.

277, Camden Road, N., July 2nd, 1878.

We need add nothing to Mr. Swainson's letter, except thanks for the trouble he has taken in compiling it.

Damage by lightning is reported to have occurred in various parts of London, but the places injured were chiefly in Camden Town and

Holloway. The following is a list of all the cases of which we have yet heard ; the places are arranged from south to north :—

- | | |
|--|-------------------------------------|
| *1. Brandram Road, Lee. | 13. Castle Road, Kentish Town, N.W. |
| 2. Westmoreland Road, Walworth. | 14. 189, Camden Road, N.W. |
| 3. Mann Street, Walworth. | 15. Hartham Road, N. |
| 4. Chatham St., Rodney Rd., Walworth | 16. Hildrop Road, N. |
| *5. Barnes Street, Limehouse. | 17. 410, Camden Road, N. |
| *6. Halsey's Place, High St., Bromley. | 18. Beau Séjour, Tufnell Park, N. |
| 7. St. Thomas's Rd., South Hackney. | 19. Topfield House, " " N. |
| 8. Richmond Road, Hackney. | 20. Annette Road, Holloway, N. |
| 9. Trelawney Road, Hackney. | 21. Holborn Infirmary, Highgate. |
| 10. London Fields, Hackney. | 22. Green Lanes, Stoke Newington. |
| 11. Murray St., Camden Town, N.W. | 23. Sewage Works, Tottenham Hale. |
| 12. St. Augustine's Rd., Camden Town, N.W. | 24. White Hart, " " |

Details respecting cases Nos. 11 to 20, inclusive, will be found in Mr. Swainson's letter. The position of all these injuries is shown upon the map by black discs, except those to which a * is prefixed, which are beyond its boundary.

Respecting the damage by the rain, we select from the newspapers some of the more important notices :—

"In a very short time the basements of many houses in the vicinity of Gloucester-gate, Regent's Park, became flooded, and in some of the bye streets leading out of the upper part of the Hampstead-road the water accumulated to such a serious extent that men were employed knee deep in opening the drain gratings with pickaxes to get rid of the overflow. Much damage it was feared has been done to the belongings of the poorer people in this locality, who were unable to remove them."—*Daily Telegraph*.

"The Holloway-road and other thoroughfares were flooded to the depth of nearly 4 ft., and owing to the bursting of overcharged drain pipes the lower floors of many houses had from 5 ft. to 9 ft. of water in them."—*Globe*.

"It would be next to impossible to describe the sudden change which came over the appearance of the streets. From being hot and dry they turned in a moment to so many running rivers of rain, and not rain only but fitful falls of hail stones. As an instance, the Holloway-road, from the Cock, at Highbury, to the Nag's Head, was so flooded that at places the water was actually making its way to the interior of the tram cars and threatening the omnibuses with inundation. The sewers, under these circumstances, soon became choked, and the water pipes bursting their bounds, vomited up volumes of water to swell the general flood."—*Standard*.

"The storm produced a serious effect on the traffic in connection with the Metropolitan Railway. Shortly after two o'clock, an unusual influx of water was making its way at various points, and near three o'clock an intimation reached Farringdon-road from the Great Northern authorities at King's Cross that the service of trains would be stopped. It seems that, coupled with the overcharging of the sewers consequent on the heavy downfall of rain, the main drain had burst at the Paul's-road Junction, on the Midland line, near Camden-square, and the water rushed in with considerable violence till it met the Great Northern system near King's Cross, and from that particular part the damage made rapid progress. Through the main line tunnel of the Metropolitan Railway, nearing Farringdon-road, the water ran freely, and it was at that portion of the line known as the 'widened way,' on the low level, that the unlooked-for destruction happened. Since half-past two yesterday afternoon, the working of the Midland, Great Northern, and London, Chatham and Dover systems at that spot has necessarily been stopped, and it is doubtful whether the traffic will be resumed for a day or two. At first the pump belonging to the company and used for ordinary pur-

poses was set to work, but the water soon got above the fire-box of the engine and rendered that useless. Aid was then obtained from the Metropolitan Fire Brigade, and steamers from Clerkenwell, St. Luke's, and Holborn were despatched to the scene. The engines were conveyed through the Great Northern 'goods' yard in Charles-street, and afterwards placed on trucks to reach the part of the line affected. At ten o'clock last night there was over nine feet of water on the line, and the power employed to lessen it seemed to have but little effect."—*Daily News*.

"The lines between King's Cross and Farringdon-street, which were flooded on Sunday last by the bursting of a sewer near the Paul's-road Junction, were cleared for traffic at one o'clock on Tuesday afternoon."—*Marylebone Mercury*.

"The station at Dalston Junction, on the North London line, was completely flooded, the water reaching nearly up to the platforms."—*North Metropolitan*.

"At the Constitution Tavern, King's-road, Camden Town, there was a sudden influx of water into the basement of the premises. It was ascertained that this was occasioned by the bursting of one of the drains, owing to the extreme pressure of the rainfall. On viewing the lower part of the premises, an almost indescribable scene presented itself. In the kitchen, where a joint was roasting before the fire, the water rose to the height of nine feet, extinguishing the fire and completely destroying everything within its reach; it also bursting open the cellar doors, carried them bodily off their hinges, and completely destroyed the contents. The hogsheads of beer were floating in the cellar. Trade at that busy hour of the day was entirely suspended. The water after completely wrecking the cellars, found an outlet by bursting down one of the outer walls, and made its way into the basin of the Regent's Canal, which adjoins the premises. The scene of the disaster was viewed by thousands of spectators during the afternoon and evening. Other houses in the district suffered, though not so severely. Both the Moreton Arms and the Clarence, public-houses in the same district, had their cellars flooded by the storm, though they were not so seriously injured. The business in them had to be suspended for a time."—*Standard*.

"The Stroud-green district, near Finsbury-park, suffered very considerably from the heavy rainfall. The water from the slopes of Crouch-hill ran down the roads like mountain torrents. The Midland Railway at Crouch-hill Station was flooded to a depth of six or seven feet, and traffic was suspended for the day after the passing of the 1.49 train from South Tottenham. The line was completely under water, when the flood was at its height, about four o'clock, from Hornsey-road Station to about a quarter of a mile beyond Crouch-hill Station, and for the whole distance the railway presented the appearance of a canal. A subsequent examination of the line by a "breakdown gang," which was sent to the scene as soon as the flood had subsided sufficiently, showed that at one point the rails were covered to the extent of fourteen or fifteen inches with sand and rubbish, while at other places trucks, beams, fences, &c., had floated upon the metals. Stroud Green-road, Mount Pleasant-road, Hanley-road, Victoria-road, and other streets leading from these were very much flooded, as much as four feet of water finding its way into the basements of some of the houses. Gardens were destroyed by the rubbish which was floated in upon them, and lawns had to be destroyed to obtain turf to stop the water from entering the doorways. Bridges were improvised at several points, but, owing to their instability, a number of rather unpleasant duckings were obtained, while at other places well-dressed persons might be seen wading through the stream. Later on the roads presented an extraordinary appearance, being silted up to such an extent as to render the divisions between carriage-way and pathway undiscernable. At half-past two the sewers had either proved unequal to the task of carrying away the superabundant water, or had burst; and the inhabitants of Stroud-green-road were first amused and then alarmed at the sight of a turbid river rushing in front of their houses in the direction of Seven Sisters'-road. In a short while gentlemen with top boots, or with bare legs, were trying to dam the yellow current. In many cases the trim lawns were already invisible, and flowering plants were fast becoming one uniform colour. Boards and carpets were brought into request,

but before much could be effected the lower levels were covered with two-and-a-feet of water, and the houses, especially those with basements, were flooded. As if the skies had not done their worst, the toilers were pelted with hailstones of considerable size. Two or three cabs, with terrified horses, arrived in the midst of the confusion, the male passengers having to take off their boots and stockings and carry the ladies into their dwellings. It was not until nearly six o'clock that the flood was really got under, but owing to the impermeable character of the clay soil, some of the back gardens were still submerged up to a late hour last night."—*Daily News*.

On the same day a very severe storm, or series of storms, occurred a little to the W. of Croydon. The lightning seems to have struck an unusually large number of objects, but as in London so at Croydon, the disruptive force exerted seems to have been generally slight. The following list will give an idea of the character of the discharges.

County Hotel, Chimney shattered.
Broad Green, Chimney corner knocked off.
North Park, Elm tree struck.
Morland Park, Tree struck.
Waddon, Tree split down centre and cottage struck.
Park Hill Road, Chimney struck.
Lansdowne Road, Chimney struck ; about 50 chickens killed under a tree.

Addiscombe, Stable struck.
Mitcham Road, House struck.
Wellesley Road, Kitchen chimney struck.
High Street, House struck.
Elmers End, Cow killed.
Overton's Yard, House struck.
London Road, Two houses struck.

Respecting the rainfall, we can hardly do better than quote Mr. Cordon's report from the *Croydon Advertiser*.

"The total fall of rain in the $2\frac{1}{4}$ hours, from 1.30 to 3.45 p.m., was 1·82 inches, and 0·02 from 3.45 to 4.45, made a total of 1·84.

$2\frac{1}{4}$ hours 1·82 inches	$\left\{ \begin{array}{l} 1.30 \text{ to } 2.0 \\ 2.5 \text{ ,, } 2.35 \\ 2.35 \text{ ,, } 2.50 \\ 3.5 \text{ ,, } 3.45 \\ 3.45 \text{ ,, } 4.45 \end{array} \right.$	1.30 to 2.0 p.m. = 0·15 in. 1st storm.
		2.5 ,, 2.35 ,, = 0·72 ,, 2nd ,,
		2.35 ,, 2.50 ,, = 0·06 ,, ,,
		3.5 ,, 3.45 ,, = 0·89 ,, 3rd ,,
		3.45 ,, 4.45 ,, = 0·02 ,, 4th in S.E.

Total ... 1·84 inches.

"The fall from 2.5 to 3.45 p.m., a space of 1 hour and 40 minutes, was 1·67 inches.

"I find that at Waddon House (P. Crowley, Esq.), 2·15 was registered ; at Tanfield Lodge, Southbridge (J. Weston, Esq.), 1·90 ; and at Addiscombe only 1·41, or a difference between Waddon and Addiscombe of 0·74 of an inch. [At Nantwich House, Mr. Baldwin Latham, C.E., measured 1·29, and at the Sewage Filter Works the fall was 2·22. The values, therefore, are consistent in showing an average of $1\frac{3}{4}$ in., half-an-inch more on the W. of the town, and half inch less on the E.—Ed. *M.M.*]

"The tremendous force of such an enormous weight of water falling in so short a space of time will be best realised by comparing it with the heavy fall on the 10th and 11th of April last, when a great deal of flooding was caused by a fall of 1·95 inches in 19 hours. On this occasion we have had nearly as much in two hours and a quarter.

"On the 30th of July, 1872, there fell 1·14 inches during a storm which lasted half-an-hour ; on the 23rd of the same month 0·55 fell in 20 minutes, and on the 11th of the same month 0·46 in 20 minutes.

"On the 24th of September, 1875, there fell in $1\frac{1}{2}$ hour during a thunderstorm 1·13 inches.

"On the 25th and 26th of July, 1867, in 24 hours there fell 2·58 inches.

"On the 11th and 12th July, 1868, in 24 hours there fell 2·03 inches

"On the 23rd of September, 1871, there fell in the night 1·55 inches."

The great feature at Croydon, or rather at Beddington and other villages W. of Croydon, was the hail. Of course we assume no responsibility for the following, but there is one point which critics sometimes forget, which it may be well to mention. The distribution of hail is excessively irregular, and there are so few skilled observers that the chances are greatly against their seeing the largest stones. To exaggerate is undoubtedly a *frequent* fault, but we do not know why it should be assumed to be universal.

Croydon.—With regard to the hailstones, various correspondents describe them as having been enormous. One person goes so far as to assert that he tried the weight of a particular hailstone, and found it to be two ounces and a half. This, however, we can scarcely credit, as to weigh two and a half ounces, a hailstone would have to be larger than a full-sized cricket ball.

Sutton.—But the most wonderful sight of all was the hailstorm. In the first part of the storm the hail came down thickly, and the stones were large, but in the second division they were much larger and fell more thickly, doing an immense amount of damage. For some minutes we seemed suddenly to have been landed by some mysterious means in the middle of December or January. The hail—large solid pieces of ice of fantastic shapes—lay thick on the ground, over which was spread a white mantle, only to be swept away by the heavy rain. The stories of the size of these hailstones must be accepted *cum grano salis*. One man positively assures us that five hailstones weighed one pound, and one of the five a quarter of a pound. Another Suttonian claims that he filled a quart measure with eight hailstones. Yet another says four of the stones weighed a quarter of a pound. But the most remarkable tale is to come. One person, a gardener, says that a large cabbage was cut down the middle with a sheet of ice, as large as a pane of glass; he was particularly careful, however, not to say how big the pane was. Without doubt the hailstones were the largest that have ever been known to fall in this neighbourhood. The storm continued till about four o'clock in the afternoon.

The damage done in Sutton alone is very great. With the exception of one district the whole of the glass used in skylights, in cucumber and other frames, in greenhouses, and in hothouses, was broken by the hailstones. Many of the greenhouses are simply frames, with hardly one inch of glass in them. Eighth-of-an-inch glass has been shattered into thousands of atoms, and strewn on the ground among the plants, doing immense damage.

Carshalton and Wallington.—The inhabitants of Carshalton claim to have had fall in their village the very largest hailstones. We have, however, already quoted the declaration of one Suttonian that five stones weighed a pound, and we do not feel disposed to go beyond this. Let each enjoy his own opinion on the point.

[We regret that the pressure of other matters prevents our giving full details of the Croydon storm of June 23rd, or of the even more remarkable one in the neighbourhood of Hertford, and south as far as London itself on June 30th. These, as well as valuable communications from Mr. Field, Mr. Ley, and others, and our own notes on the Paris Exhibition, and upon Books received, must stand over till next month.—*Ed.*]

INTERNATIONAL METEOROLOGICAL CONGRESS, PARIS.

[THE Société Météorologique de France has just issued the provisional programme for the Congress, which is to be held in August next. As many of our readers may be glad to have early information respecting the arrangements, we give translations both of the invitation circular and of the programme, for copies of which we are indebted to the courtesy of M. Leon Teisserenc de Bort.—*Ed.*]

INTERNATIONAL METEOROLOGICAL CONGRESS.

SIR,—By virtue of a decree dated June 7th, 1878, by the Minister of Agriculture and Commerce, an International Meteorological Congress has been authorised to hold its sittings in the Trocadéro Palace, from the 24th to the 28th of August.

I have the honour, in the name of the Société Météorologique de France, and of the Organizing Committee, to request your support for this Congress, of which the first meeting will be held at 3.30 p.m. on August 24th.

The meeting, to which Meteorologists are invited, on account of the Universal Exhibition of 1878, has no official character, and in no way encroaches upon the attributes of the periodical International congresses.

You will find annexed a provisional programme of the questions which may occupy the Congress. I request that you will have the kindness to acknowledge receipt of this letter, and to inform me of the subjects upon which you desire to speak, or of any which you think should be added to the provisional programme.

The Société Météorologique de France and the Organizing Committee will thankfully receive any remarks you may be good enough to send.—I am, Sir, &c.,

HERVÉ-MANGON,

*President of the Organizing Committee and of the
Société Météorologique for 1878.*

MEMBERS OF THE ORGANIZING COMMITTEE.

Council of the Société Météorologique :

MM. Hervé-Magnon, de l'Institut ; le général Farre ; d'Abbadie, de l'Institut ; le docteur Lunier ; Dausse ; G. Lemoine ; L. Teisserenc de Bort ; Sartiaux ; L. Rédier ; Angot ; Renou ; Janssen, de l'Institut ; Delesse ; Cousté ; G. Tissandier ; le docteur Decaisne ; Brault ; du Moncel, de l'Institut ; P. Marès ; Lavallée ; Chatin, de l'Institut ; Mouchez, de l'Institut ; Bérigny.

Delegates of l'Association Française :

MM. Baille ; Bischoffsheim ; Gavaret ; le Colonel Laussedat.

Delegates of l'Association Scientifique :

MM. Cornu, de l'Institut ; Fron ; l'amiral Paris, de l'Institut ; Ploix.

The following subjects have been provisionally adopted by the Organizing Committee. Learned societies and savants of any nation who may have other questions to suggest are requested to submit them to the Committee as quickly as possible.

Letters, memoirs, and all documents whether printed or in MS. relating to the Congress, should be addressed to M. Hervé-Mangon, rue des Grands-Augustins, No. 7, à Paris.

PROVISIONAL PROGRAMME OF SUBJECTS TO BE DISCUSSED.

- I.—What is the present organization for the study of storms in Europe and in America? What steps should be taken to ensure uniform data for the study of their progress, not only over a limited space, but across an entire continent?
- II.—What is the best mode of representing storms and their progress? What symbols and what abbreviations can be adopted in order to facilitate the understanding by Meteorologists of all nations of storm maps. (Meteorologists are requested to send to the Committee specimens of the various printed or MS. storm maps used in their respective countries.)
- III.—Origin and mode of propagation of waterspouts or cyclones.*
- IV.—What is the explanation of those waterspouts at sea and on land which appear to be formed and maintained in a dead calm?
- V.—What steps should be taken to render the observations taken during balloon ascents more numerous and complete? On the employment of captive balloons.
- VI.—Discussion upon the methods of observing terrestrial magnetism, and on the variations of declination and horizontal force with various atmospheric phenomena.
- VII.—The connection between Sun-spots and meteorological phenomena.
- VIII.—Influence of the contour of the ground and the nature of the soil on the climate of different countries; effects of the proximity of the sea, of lakes, marshes, streams, and of varied cultivation.
- IX.—Influence of cultivation, of *grassing*, and of replantation, upon the production of dew, on the amount of rainfall and on its discharge from the surface of the earth.
- X.—Observations upon the level of streams. System of warning respecting floods.
- XI.—On the progress actually made in seismological enquiries.
- XII.—Origin and nature of dry fogs.
- XIII.—On the best means of stating, in meteorological studies, the variations in the elements of the atmosphere and in the water therein contained. (Carbonic and nitric acid, ammonia, ozone, atmospheric dust, miasma, &c.)
- XIV.—What is the value of ozone papers?
- XV.—What steps should be adopted in order to hasten the progress of chemical meteorology.
- XVI.—On the importance of self-recording instruments as related to the progress of meteorology.

* *Trombes ou Cyclones*.—We have always considered that the word "trombe" was the equivalent of the English "waterspout," but the connection in which it is used, both in III. and IV., almost induced us to render it "whirlwind." Having stated what it is in the original, we must leave it to French scholars to correct us. But waterspouts and cyclones are so different that it seems rather strange to couple them with the word "or."

NOTE.—The following questions, which belong to the programme of the periodical International congresses, are only to be considered in a preparatory manner, in order to collect data for future decision.

- XVII.—Can precise rules be given as to the best mode of placing thermometers in order to ascertain shade temperature. (Meteorologists are requested to send or to bring to the Congress drawings of the thermometer stands employed in their respective countries, and a note indicating the advantages and disadvantages of each.)
- XVIII.—What are the hours of observation in each country for stations of the 1st, 2nd, and 3rd order?
- XIX.—What hours are to be recommended generally?
- XX.—On the methods of measuring evaporation.
- XXI.—The measurement and distribution of rain; the measurement of snow.
- XXII.—Have any recent researches been made upon a method at once simple and certain for determining radiation?
- XXIII.—Methods of observing atmospheric electricity; origin and nature of variations therein.
- XXIV.—On the desirability of making synchronous observations at sea, and on the steps to be taken for the purpose of obtaining them.

THE WEATHER IN JUNE.

THE readings of the barometer were exceedingly uniform at the beginning of the month, and the winds were light except in Denmark, Sweden, and the S. of Norway, where strong westerly winds prevailed. The first week was one of showery weather, the showers becoming heavier as the week advanced. Southerly winds were prevalent in Ireland and England, with easterly to south-easterly winds in Scotland, and temperature increased slowly all over the country. On the 4th a small, well-defined depression advanced to the St. George's Channel; the mercury fell briskly in its immediate vicinity, and slightly in all other parts of Western Europe. During the day the depression moved slowly westward, and by the morning of the following day it was found over N. Germany, where the mercury was falling, but in all other places a recovery was taking place. On the 8th the weather became very unsettled; thunderstorms of considerable severity occurred in the S. and S.E. of England, the fall of rain in some cases being heavy.

The weather continued very unsettled during the second week. Pressure was highest in the south, and during the 9th, 10th and 11th depressions crossed these Islands from west to east, and though causing heavy showers, they were unimportant, excepting that of the 11th. As this disturbance passed across, the wind which blew first from the S. and afterwards from the W. and S.W., rose to a moderate gale over the greater part of the country, and to a fresh or hard gale in the S. and S.W. In the rear of this depression the barometer rose briskly, and a sudden fall taking place in France, the highest readings were found in these Islands. The distribution of pressure became very complicated, and the wind varied considerably in direction. Temperature was low, the weather cloudy and very showery.

On the 16th a depression originated in Bohemia, and advanced in a north-westerly direction to Holstein, on the 17th over the west of Norway, and the 18th and 19th between the Scotch and Norwegian coasts, where it appears to have become dispersed.

After the disappearance of this depression, readings of the barometer became high and uniform, light S.W. to W. breezes prevailed, and temperature gradually rose and reached a maximum of 90° in South London on the 22nd. From this time

till the close of the month the changes in atmospheric pressure were comparatively slight and unimportant. During the early portion of the last week readings were highest in the east, and lowest in the west, and at the close, highest in the north and lowest in the south.

On the 29th an anticyclone was stretching from the east coast of Scotland to the W. of Norway, while an area of low pressure (exhibiting at least two distinct minima) lay over the Channel and France. Later in the day the barometer was found to be falling slowly everywhere, and a small depression advanced eastward up the Channel. On the 30th the barometer was rising over the Channel and the west of France, and also in the N. of Scotland, but falling elsewhere. Two regions of high pressure were shown, one over Scotland and the other over the south of France, and gradients continued slight. The weather became overcast in the south-east of England as well as in North Britain, but in the west of these Islands and on the Continent it continued fine. Thunderstorms occurred over all our southern counties and at Brussels; the showers in some cases were very heavy

H. E. M.

SUPPLEMENTARY TABLE OF RAINFALL IN JUNE, 1878.

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

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	1.13	XI.	Solva	3.64
„	Littlehampton	1.99	„	Castle Malgwyn	3.90
„	Hailsham	1.65	„	Nantgwilt, Rhayader ...	4.72
„	St. Lawrence, I. of W....	.80	„	Carno	4.18
„	Strathfield Turgiss	1.23	„	Rhug, Corwen	3.64
III.	Addington Manor	2.19	„	Port Madoc	3.38
„	Oxford	1.91	XII.	Carsphairn	2.32
„	Northampton	3.84	„	Melrose	2.25
„	Cambridge.....	3.16	XV.	Grainart	3.11
IV	Sheering	2.57	XVI.	Grandtully .....	...
„	Diss .....	.77	XVII.	Tomintoul.....	1.61
„	Swaffham	2.27	„	Keith	1.24
V.	Alderbury, Salisbury ...	2.99	XVIII.	Dalwhinnie	2.25
„	Compton Bassett	2.96	„	Auchnasheen	3.51
„	Dartmoor	4.42	„	Springfield, Tain	2.19
„	Teignmouth	2.76	„	Glenfinnan .....	...
„	Langtree, Torrington ...	2.89	XIX.	Watten .....	.88
„	Cosgarne, St. Austell ...	3.43	XX.	Glenville, Fermoy	6.83
„	Taunton.....	2.66	„	Tralee	4.95
VI.	Bristol	3.08	„	Tipperary	7.92
„	Sansaw .....	...	„	Newcastle W., Limerick	6.27
„	Cheadle	3.67	„	Kilrush	4.48
„	Bickenhill Vicarage .....	...	XXI.	Kilkenny	5.63
VII.	Coston, Melton Mowbray	2.50	„	Kilsallaghan	5.03
„	Bucknall	1.69	„	Twyford, Athlone	7.37
VIII.	Walton, Liverpool	2.79	„	Belvedere, Mullingar ..	...
„	Broughton-in-Furness ..	3.65	XXII.	Ballinasloe	5.17
IX.	Stanley, Wakefield	3.17	„	Kylemore	11.32
„	Mickle, Ripon	3.35	„	Carriack on Shannon.....	4.55
„	Whitby .....	...	XXIII.	Rockcorry	6.80
X.	Gainford	2.90	„	Warrenpoint	2.72
„	Unthank Hall	3.52	„	Newtownards	2.25
„	Shap	2.63	„	Bushmills	3.99
IX.	Llanfrechfa	5.91	„	Buncrana	3.16

JUNE, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which ≥1 or more fall.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.	Deg.		Date.	Deg.	Date.	In shade	On grass.	
		inches	inches.	in.									
I.	Camden Town	6.71	+ 3.66	3.28	23	15	86.5	26	41.6	2	0	0	
II.	Maidstone (Hunton Court)...	1.94	— .78	.70	29	13	...	...	...	...	...	...
III.	Selborne (The Wakes).....	1.56	— 1.67	.42	11	11	82.0	26	41.0	1	0	0	
III.	Hitchen	2.45	— .19	.52	12	15	80.0	27	37.0	14	0	...	
IV.	Banbury	2.04	— 1.24	.50	2	15	86.5	27	43.0	15	0	...	
IV.	Bury St. Edmunds (Culford)...	1.07	— 1.51	.30	12	10	87.0	26	35.0	1	0	1	
V.	Norwich (Sprowston) .....	...	...	...	...	...	...	...	...	...	...	...
V.	Bridport	1.29	— 1.95	.50	10	8	...	...	...	...	...	...
"	Barnstaple	3.07	— 1.05	.56	9	13	87.0	28	44.0	2	0	...	
"	Bodmin	4.10	+ .06	.88	10	18	82.0	26*	47.0	12†	0	0	
VI.	Cirencester	3.01	— .37	.57	9	17	...	...	...	...	...	...
"	Shifnal (Haughton Hall) ...	2.57	— .54	.53	29	13	83.0	26*	38.0	6	0	...	
"	Tenbury (Orleton)	3.19	— .33	.49	11	16	86.0	26	38.0	6	0	0	
VII.	Leicester (Town Museum) ...	1.70	...	.44	9	15	85.0	26*	41.5	6	0	...	
"	Boston	1.84	— .35	.82	4	12	88.0	26	40.0	15	0	0	
"	Grimsby (Killingholme)	2.73	...	.77	3	11	80.5	26	43.0	2, 6||	0	...	
"	Mansfield	2.40	...	.58	4	13	88.6	27	38.2	2	0	0	
VIII.	Manchester (Ardwick).....	2.74	— .34	.59	11	12	91.0	27	42.0	6	0	...	
IX.	York .....	...	...	...	...	...	...	...	...	...	...	...
X.	Skipton (Arnccliffe)	3.77	— .33	1.25	11	16	87.0	26	36.0	13	0	...	
X.	North Shields .....	...	...	...	...	...	...	...	...	...	...	...
XI.	Borrowdale (Seathwaite).....	6.13	— 4.38	2.13	11	11	...	...	...	...	...	...
"	Cardiff (Crockherbtown).....	3.68	...	1.65	16	15	85.5	27	46.2	17	0	0	
"	Haverfordwest	3.92	+ .27	.90	10	10	83.0	27	41.5	18	0	...	
"	Aberdovey	2.30	...	.47	3	14	95.0	26	47.0	1, 6	0	...	
"	Llandudno	1.68	— .61	.48	3	12	93.0	27	45.8	1	0	...	
XII.	Dumfries (Crichton Asylum)...	2.48	— .35	.89	10	8	85.5	28†	35.0	5	0	...	
"	Hawick (Silverbut Hall).....	3.68	...	1.20	2	13	...	...	...	...	...	...
XIV.	Glasgow (Cessnock Park) ...	2.54	...	...	...	...	76.0	...	...	...	...	...
XVI.	Mull (Quinish)	3.25	...	.70	8	12	...	...	...	...	...	...
"	Loch Leven .....	...	...	...	...	...	...	...	...	...	...	...
"	Tyndrum (Ewick) .....	...	...	...	...	...	...	...	...	...	...	...
"	Arbroath	2.87	+ .34	.92	7	12	81.0	28	39.0	1	0	...	
XVII.	Braemar	2.85	— .59	.95	7	9	80.5	27	35.0	1	0	3	
"	Aberdeen	1.66	...	.56	7	9	78.5	26	39.5	15	0	1	
XVIII.	Gairloch	2.85	...	.92	27	8	...	...	...	...	...	...
"	Portree	3.96	— .82	.96	27	15	...	...	...	...	...	...
"	Inverness (Culloden)	2.29	+ .37	.51	8	19	82.8	28	33.9	5	0	2	
XIX.	Dunrobin .....	...	...	...	...	...	...	...	...	...	...	...
"	Sandwick	1.25	— .29	.41	8	11	73.0	25	36.8	7	0	2	
XX.	Caherciveen Darrynane Abbey	5.24	...	.65	3	22	...	...	...	...	...	...
"	Cork	7.47	...	1.57	28	17	...	...	...	...	...	...
"	Waterford .....	...	...	...	...	...	...	...	...	...	...	...
"	Killaloe	7.96	+ 4.33	1.23	26	19	82.0	30	38.0	19	0	...	
XXI.	Portarlington	3.86	+ .61	.77	28	24	72.0	26	40.5	1	0	0	
"	Monkstown, Dublin .....	...	...	...	...	...	...	...	...	...	...	...
XXII.	Galway	5.92	...	1.35	27	22	78.0	30	42.0	1	0	...	
XXIII.	Waringstown	3.96	...	.93	27	17	81.0	28	41.0	1, 5§	0	...	
"	Edenfel (Omagh)	2.96	...	.54	27	18	76.0	28	36.0	4	0	...	
"	Ballyshannon	4.45	...	.90	26	20	...	...	...	...	...	...

* And 27. † And 29. ‡ And 20. || And 15. § And 6.

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

METEOROLOGICAL NOTES ON JUNE.

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.—Prevailing wind, S.W. and W.; T and L on 15th; T on 16th, 17th, 18th, 29th, and 30th.

BANBURY.—Temp. above 80° on four days, and above 70° on eleven days. T and L on 16th and 29th; T on 19th and 26th. A fine meteor seen at 10 p.m. on 7th.

CULFORD.—Up to the 19th the weather was mostly cold; it then became warm, and from the 23rd to the 28th may be said to have been hot; from the 28th to the end of the month it was fine although overcast and cloudy. Mean temp. 59°·6. Easterly wind prevailed during twelve days; high wind on 12th; T on 23rd.

BODMIN.—Mean temp. of month, 63°, being 2° above the average.

SHIFNAL.—R, with four exceptions, every day till 14th, when a dry period set in, the heat increasing gradually till the 23rd, when it became intense, and on the 26th and 27th the temp. reached 83°, which has only been exceeded once in 42 years (viz., in 1858, when 85° was registered), followed on the 29th by a severe TS, with heavy R. T also on 17th, 23rd, and 28th. Great crop of hay. Red Admiral butterfly seen on 1st; humming bird Sphinx on 15th.

ORLETON.—The weather was generally cloudy and sunless, with a low but even temp., and R almost every day till the 18th. The temp. never reached 70° till the 20th, but for six days from that date it reached or exceeded 80°. TS on 13th, 17th and 26th, and T was heard on many other days, but generally very distant. Mean temp. of month nearly 1°·5 above average.

LEICESTER.—T and L at 6 p.m. on 26th, and T on 29th.

BOSTON.—This district has so far fortunately escaped the heavy TSS which have occurred in other parts of the country, and the weather has been everything that could be desired to mature the crops. The mean temp. of the month was 1°·7 above the average of 14 years, the last part of the month being specially sunny and hot, the max. in the shade on the 26th rising to 88° (the highest recorded by me, the nearest being 85°, in 1865). Hay is being rapidly got in, in splendid condition, with very little labour, although the crops are very heavy. Wheat came in ear about the 17th, the magnificent weather following being most favourable to mature the grain. The crops all through this district look splendid, and there is every prospect of an abundant harvest.

KILLINGHOLME.—Up to the middle of the month, wet and cloudy, the latter half very dry, with many days of more than usual heat, with E. winds. Garden crops forward; a few ears of wheat clear of the sheath on 15th. T and L on 8th and 10th; T on 4th, 9th, and 19th; H on 10th; fog in early morning of 20th. Dog-rose in flower on 8th.

MANSFIELD.—TS on 9th and 11th; T on 23rd and 26th; very hot on 26th and 27th.

ARNcliffe.—First half of month dull and sunless; from the 16th very hot and dry. Temp. in shade at 7 p.m. on 26th, 78°. Much T on 27th, but no R.

WALES.

CARDIFF.—A heavy TS with H on 16th, commencing at 10.20 a.m. T on 29th and 30th.

HAVERFORDWEST.—A very fine, warm month. Hay crop much above the average. Temp. above 70° on seven days. Very heavy R during the night of the 10th and morning of the 11th, '40 in. fell in twenty minutes; and at 9 a.m. on the 16th, '42 in. fell in half-an-hour. T on the 18th and 23rd; great heat with bright weather from 21st to 30th. Two severe TSS on 29th; the morning was very sultry, and about 11 a.m. large masses of copper-coloured cumuli were seen in the N.E., and a similar bank of portentous appear-

ance in the S.S.E. The storm commenced about noon, when the sky became almost dark and H fell in the form of irregular-shaped pieces of clear ice, some an inch in length; L of the most zigzag shape, followed immediately by T, continued for a couple of hours, a horse near the town and a stack of chimneys being struck. The second storm, of equal violence and during which the L was remarkably vivid and forked, took place from 5 to 7 p.m.; 11 in. of R and H fell in the first storm, and 39 in. in the second. Considering the magnitude of the storm the R was remarkably small.

ABERDOVEY.—From the 1st to the 12th it was generally wet, afterwards it was warm and dry, the heat on the 26th and 27th being intense. Fine hay harvest, with heavy crops. Distant T on 16th; TS on 28th.

LLANDUDNO.—A very fine month, especially the last 12 days; intensely hot on the 27th, when the unprecedented temp. of 93° was registered. I mean unprecedented in Llandudno in my experience, extending over a period of nearly twenty years. Mean temp. about 2° above the average. A splendid hay harvest, and an abundant crop.

SCOTLAND.

DUMFRIES.—The weather of June was uniformly fine, the rainfall was light, and the mean temp. (55°·4) above the average. Wind light and generally southerly. The last three days were unusually warm. T and L recorded twice.

HAWICK.—Continuous E. wind till 15th, when it changed to W. T showers on 19th, and a severe TS on 26th. Hay harvest has begun, and the crop is a heavy one.

QUINISH.—A very beautiful month. Heavy T showers and distant T and L from noon till 9 p.m. on 27th.

ARBROATH.—The max. temp. on 28th (81°) is the highest recorded since July 21st, 1873, when the temp. was the same.

BRAEMAR.—Severe T and L on 27th from 2·15 to 3 p.m.; no R.

ABERDEEN.—A fine, warm month; last ten days unusually warm. Mean temp. 55°·7, slightly above the average. T on 10th and 19th.

PORTREE.—The finest June on record. Heavy S. gale from noon till 8 p.m. on 20th, and heaviest and longest TS known in this island on 27th; it commenced from S.S.W. at 11 a.m. and continued till 1 a.m. on 28th; the lightning was almost incessant and very vivid; a woman was killed in the S. of the Island.

CULLODEN.—Distant T on 10th. Very severe storms of T, L and R on 27th and 28th.

SANDWICK.—Weather generally dry and pleasant, but very hot for this latitude, from 24th to 29th, when the ther. in shade was as high as 73°, and black bulb ther. in vacuo 152°·1! On the 30th the wind changed to N., and the weather became cool. On the 27th a TS passed west of this station between 4 and 6 p.m., going from S.W. to N.W.; it exhausted itself in the Atlantic, and only a few drops of R fell here.

IRELAND.

DARRYNANE.—A wet and ungenial month, with a few very fine days; wind variable and usually slight. Potato disease appeared in the middle of the month, but has not shown itself to any extent except here and there.

KILLALOE.—Rainfall excessive, and a good deal of T and L towards the end of the month; all crops suffering from heavy rains. Potato blight appeared about the 20th, and is increasing. Mean temp. 60°·7.

EDENFEL.—Weather up to the last week rather broken, with frequent short heavy showers and a considerable amount of T and L; the last week was fine, clear and hot. On the whole, the promise of an unusually abundant and early harvest is being fully maintained.

BALLYSHANNON.—The month was marked by heavy rainfalls, often of short duration. A good deal of T and L, and the temp. has been high.

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THE JUNE THUNDERSTORMS.

(*Continued from page 89.*)

WE were obliged to conclude our notice of the storms of June 23rd rather abruptly, and we can now only add respecting the Croydon storm a small portion of Mr. Mawley's report :—

“*Summary.*—(1.) This storm after depositing a few drops of rain at one o'clock, came on very suddenly and in full force 36 minutes later, with heavy rain and vivid lightning frequently repeated, and followed in each case almost immediately by thunder. (2.) This thunder had a peculiar loose crackling sound. (3.) Between 1.34 and 2.15 the storm-cloud remained very near, and again between 3.35 and 3.50. (4.) The fall of rain was very heavy at times. (5.) Hail of rather large size fell with the rain between 2.36 and 2.40, and unusually large hailstones fell thickly and alone for about four minutes from 3.10. The leaves of many plants were pierced here and there by the hail, and their edges slit by it. Nearly the whole of the leaves of a strawberry bed were much injured, not so much riddled or slit as bruised by the hailstones. These strawberry leaves at the time of writing, July 4th, have not yet recovered and still remain curled up all over the bed. (6.) Between 2.1 and 2.8 no rain at all fell, and again between 4.10 and 4.38. The total between 1.36 and 4.55 p.m. was 1.41 in.”

Before proceeding it will be well to summarize the facts previously stated—(1.) A thunderstorm in W. London on 16th. (2.) An excessively heavy rain (max. 3.28 in.), accompanied by much lightning in the north of London about 2 p.m. on 23rd. (3.) A heavy rain (max. 2.22 in.), with lightning and much large hail, slightly west of Croydon, about 2.30 p.m. on the same day.

On the next Sunday, June 30th, a similar heavy storm occurred over the south-east of Hertfordshire, East Essex, and North Middlesex. We cannot enter fully into the details of the damage at Hertford, Hatfield, Ware, Cheshunt and Waltham Cross, but we may select a few statements :—

Hertford.—The Essendon Road for some distance on the Hertford

side of the Horns Mill was impassable, and the Lodge at the entrance to Hertingfordbury Park was not only surrounded but nearly two-thirds covered with water. The total damage must be many thousand pounds.

Ware.—The line between Hertford and Ware was submerged, though not sufficiently to interrupt traffic. But all along the Great Eastern line the land was so flooded as to resemble a vast lake.

Hatfield.—The lower parts of the town were much flooded, the water was three feet deep in the Post Office, and also in the adjoining Public Library, where about 500 volumes were spoiled. A large private house was flooded, five feet of water being measured in the drawing room.

Cheshunt.—At Waltham New Town the road was covered by 3 or 4 feet of water, and some houses were not freed from it until Tuesday, July 2nd.

Mr. Clinton Baker, F.M.S., of Bayfordbury, has sent the following details of the fall of rain at his station :—

Rain, 11.30 a.m. to 1.45 p.m. ($2\frac{1}{2}$ hours)	= 1.85 in.
2 p.m. to 4.30 p.m. ($2\frac{1}{2}$ hours)	= 1.27 in.
4.30 p.m. to 9 a.m. July 1st	= .56 in.

Total in 24 hours = 3.68 in.

He has also favoured us with the following extract from a letter by Mr. Mylne, C.E., F.R.S., of Amwell :—

“The appearances indicated a storm working N. from Enfield Chase, and another from Bishop’s Stortford working due W., which appeared to meet near Hertford and culminate between Bayford and Hatfield.”

Mr. Mylne reports the rainfall to have been—

11.30 a.m. to 1 p.m. {	2.35 in.
1.30 p.m. to 5 p.m. {	
5 p.m. to 9 a.m. July 1st	.37 in.

Total in 24 hours 2.72 in.

The *Hertfordshire Mercury* gives the following additional values, “Poles, Ware, 2.14 in.,” and “Hatfield Park, 2.90 in.” It also gave the report of the Surveyor of County Bridges enumerating five damaged bridges, and asking a vote of £500 for their repair.

At Camden Square rain began at 0.38 p.m. on 30th, but was not measureable until 0.43 p.m. ; in the next five minutes 0.16 in. fell : in the next, 0.10 in. ; and in the next, 0.05 ; or 0.31 in. in a quarter-of-an-hour. It continued to rain steadily during the subsequent six hours, so that the total fall was 1.13 in.

At Eltham, 1.32 in. fell in the forty minutes between 2.17 and 2.57 p.m. At Winchmore Hill 0.98 in. fell in thirty-eight minutes between 0.10 and 0.48 p.m., while between 4 and 4.14 p.m.—*i.e.*, in fourteen minutes the enormous amount of 1.08 in. fell ; and by

5.55 p.m. the total fall was 2.31 in. At Enfield, the rain was even heavier, the total being 3.07 in., which the observer reports to be the largest amount he ever measured.

The rainfall was also heavy at the following stations, though by no means as great as in the neighbourhood of Hertford and Enfield:—Ware, Much Hadham, 1.95 in., 1.60 in. of which fell between 3 and 4 p.m.; Upper Clapton, 1.65 in., mostly between 1.50 and 6.30 p.m.; and Hackney, 1.04 in.

THE PARIS METEOROLOGICAL CONGRESS.

It speaks favourably for the probable success of the above meeting, that many foreigners have already promised to assist. We believe that there are many whose names we have not received, but the following is a very good first-list:—

AGOSTINI, of Modena.
BUYS-BALLOR, of Utrecht.
DA SCHIO, of Vicence.
DENZA, of Moncalieri.

HOFFMEYER, of Copenhagen.
RAGONA, of Modena.
SYMONS, of London.

Of course, the principal strength will be in the French Meteorologists, and we hear that they will assemble from many of the most distant parts of France, *e.g.*, CROVA from Montpellier, and FINES from Tarbes.

COWL TESTING AT KEW OBSERVATORY.

THE influence of the shape and aspect of buildings upon the indications of anemometers placed upon them, has often been insisted upon in these pages. We are inclined to hope that some light will be thrown upon that subject, and also upon the vexed question of discordant results from roof rain-gauges, by experiments now in progress at Kew.

Certain patterns of so-called Suction Cowls—*i.e.*, cowls assumed to possess the power of sucking air up tubes on which they are placed—were exhibited at the meeting of the Sanitary Institute, at Leamington, in 1877. Three of them were referred to a sub-committee for examination and testing, and they, as well as some others, have been under trial at the experimental house at Kew for several months. The details of the experiments have not yet been published, but from what we have heard we think it probable that they will be almost equally valuable to Meteorology and to Sanitary Science. A rough sketch of the arrangements is given in the *Sanitary Register* for July, 1878.

DIFFERENCE OF RAINFALL WITH ELEVATION.

To the Editor of the Meteorological Magazine.

SIR,—The observations by Mr. Dines on the experimental rain gauges fixed on his tower, given in the *British Rainfall* for 1877, are

extremely interesting, and a careful discussion of them will be found to bring out some very remarkable results. In the following table I have supplemented the observations given in the *British Rainfall* by a number of others selected from Mr. Dines' returns (the entire series of which he has kindly placed at my disposal), and have sorted the observations into groups according to the direction of the wind blowing at the time the rain was falling, the last group being those observations when there was practically no wind at all. I have also calculated the ratios of the rainfall in each of the gauges on the tower to the rainfall on the ground, and averaged the ratios for each group.

A mere inspection of the table will shew that though there is considerable irregularity in the ratios, there are certain unmistakeable general features running all through them. Thus, the stronger the wind the less the ratio, the lighter the wind the greater the ratio; in one and the same group one gauge has generally the predominance through all the observations, and in different groups the gauge which has the predominance changes as the direction of the wind changes.

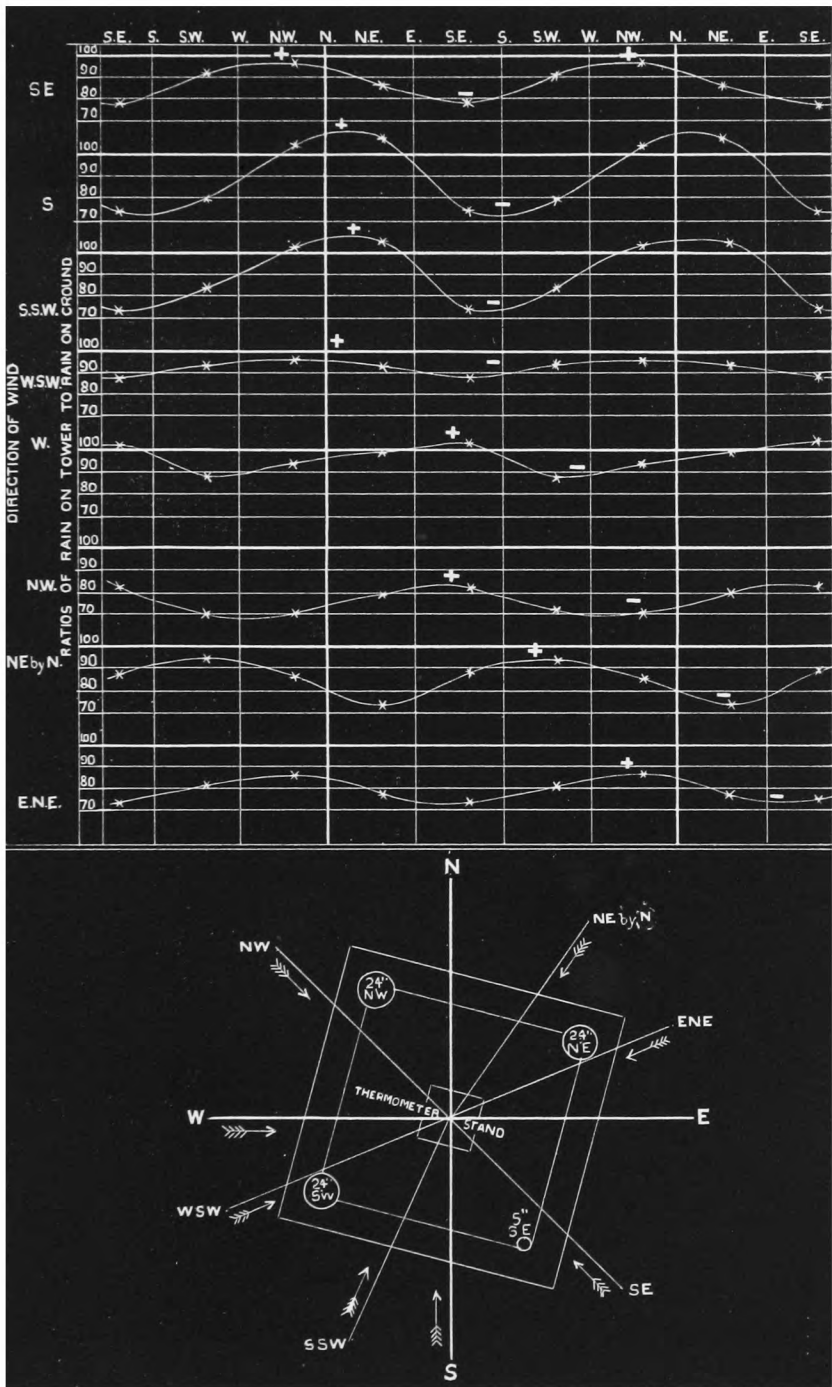
By plotting the average ratios given in the table so as to form curves, as on the annexed diagram, the general features are brought out much more distinctly, and the laws which govern the variation of the ratios elucidated.

The upper diagram shows the varying ratios of the rainfall on the tower to the rainfall on the ground. The horizontal lines represent the ratios, and the vertical lines the cardinal points of the compass to fix the bearing of the different tower gauges. It will be seen that there are eight series of curves corresponding to the eight groups in the table, each curve representing the average ratio of the rainfall on tower to that on ground, with a given direction of wind. The asterisks represent the points of the curve given by observation, *i.e.*, the ratios corresponding to the *different tower gauges* ranged under the proper points of the compass—the asterisks under S.E. referring to the S.E. tower gauge, those under S.W. to the S.W. tower gauge, and so on. The asterisks are repeated so as to prolong each curve beyond its proper length, in order to bring out its form more clearly. The + sign marks the maximum, and the - sign the minimum ratio for each series.

The lower diagram is a plan of the top of the tower, showing the rain gauges. The circles at each corner show the gauges (three 24 in. and one 5 in.), which are called as in Mr. Dines' paper, S.E., S.W., N.W., N.E., though, as it will be seen, the bearing of the corners of the tower differ slightly from true S.E., S.W., N.W., N.E. The lines with arrows represent the eight directions of wind corresponding to the eight curves given above. The centre part of the tower is occupied by a thermometer stand, 3 feet square, rising above the top of the tower, which stand we shall see further on has considerable influence on the results.

On examining the curves we see that each series of ratios has a well defined maximum and minimum, and that the maxima and minima

DIFFERENCE OF RAINFALL WITH ELEVATION.



have a progression from left to right on the diagram, following the alteration of the direction of the wind ; in other words, as the direction of the wind alters from S. through W. to N. the maxima and minima alter likewise from S. through W. to N. It further appears that the minimum ratio is at or near the point where the wind strikes the tower, and the maximum ratio at the opposite point—thus, in the first curve, with the wind at S.E. the minimum ratio is at the S.E. gauge, and the maximum at the N.W. gauge ; in the second curve, with the wind due S., the minimum ratio is *between* the S.E. gauge and the S.W. gauge, or about S., and the maximum *between* the N.W. and N.E. gauges, or about N.

The above of itself is, I think, sufficient to prove that the variation in the ratios is due to variation in the direction of the wind, but a little closer examination of the details will show this more clearly still. It will be noticed that in the curves for the S., S.S.W. and W. winds the maximum ratio exceeds 100, but that in all the other curves the maximum is less than 100. On looking at the lower diagram it will be seen that the above three directions of wind are the only ones in which the thermometer stand cannot shelter any of the gauges. With all the other winds this stand more or less shelters the gauge opposite to the point where the wind strikes the tower, and thus reduces the maximum below its normal amount. Moreover, the nearer the direction of the wind to the line of greatest shelter the more the maximum is reduced below 100, as will be seen by comparing the two last curves (N.E. by N. and E.N.E.)

In addition to the disturbance introduced by the sheltering of the thermometer stand, there is also another cause of disturbance, viz., that the S.E. gauge is different from all the others, being 5 inches in diameter instead of 24 inches, and placed with its top 1 foot above the parapet instead of 6 or 7 inches, as in the case of the other gauges. From a comparison of the curves as well as from the other observations given in Mr. Dines' paper, I think there cannot be a doubt that the 5 in. S.E. gauge collects less rain than the other 24 in. gauges, notwithstanding that Mr. Dines has come to the contrary conclusion in his paper.

After making due allowance for the above disturbing causes, and for the uncertainty in many cases as to the precise direction of the wind at the time the rain was falling, I would submit that the preceding discussion of Mr. Dines' observations proves the following points :—

(1). That the ratio of the rainfall on the tower to the rainfall on the ground depends on the force and direction of the wind.

(2). That when there is no wind the amount of rainfall on the tower is about the same as that on the ground.

(3). That when there is wind the amount of rain falling on the tower will vary on different portions of the tower, the portion nearest the point at which the wind strikes the tower receiving less rain than

falls on the ground, and the portion furthest from the point at which the wind strikes the tower receiving the same or more rain than falls on the ground.

(4). That the excess of rain falling on the portion of the tower furthest from where the wind strikes will, to a large extent, compensate the deficiency of rain on the portion nearest to where the wind strikes, but whether to a sufficient extent to make the average amount of rain falling on the tower equal to that falling on the ground, cannot be determined from these experiments.

This letter has already extended to such a length that I am unable to enter into the question of what is the precise action of the wind which reduces the amount of rain falling on one portion of the tower and increases that falling on other portions. I may, however, say that I agree generally with the view expressed by the Rev. F. W. Stow in his able paper in *British Rainfall*, 1871, viz., that the wind is deflected by buildings so as to cause upward and downward currents of air, which distribute the rain unequally. I am hoping shortly to make some experiments on this subject myself for another purpose, which may throw some further light on the matter.

I think it very desirable that Mr. Dines' experiments should be continued, but the thermometer-stand should certainly be removed, and a 24 in. gauge substituted for the 5 in. gauge, at the same level as the other gauges, so as to obviate the disturbing causes already alluded to. Another 24 in. gauge ought to be similarly placed in the centre of the tower (where the thermometer stand now is). I also entirely agree with Mr. Dines that some means should be adopted for determining the force and direction of the wind at the exact time when the rain fell.

I am, Sir, yours obediently,

ROGERS FIELD.

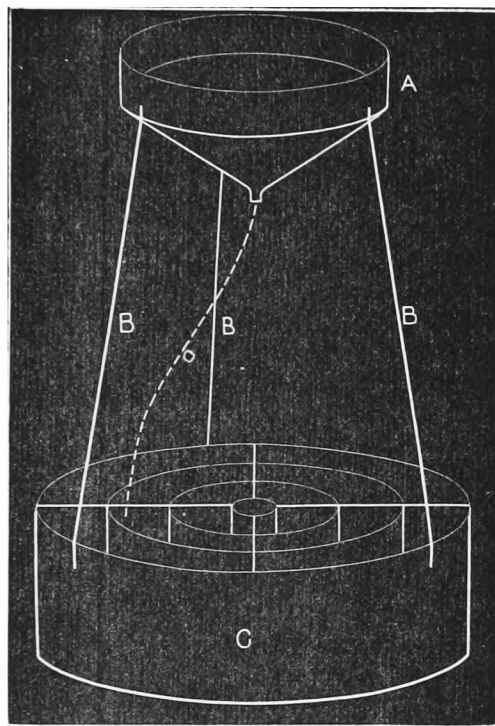
5, Cannon Row, Westminster, S.W., July, 1878.

[We think that experiments somewhat resembling those of Mr. Dines's, with four rain gauges at the top of one tower, were tried about twenty years since, either in Denmark or the United States. We have entirely forgotten the results and have but a very dim recollection of the circumstance; any one who can give full particulars will be rendering a service to all students of the subject. With reference to measuring the force and direction of the wind at the exact time when the rain falls, we venture to sketch a very rough plan, which may be better than more costly apparatus, as (1) it will always work when there is rain, (2) it will never work except when there is rain, (3) rain and wind are the only elements concerned. A is a funnel supported by three thin rods B B B, C is a receptacle divided into annular rings, and again subdivided into four quarters. Whenever there is rain it will drip from the bottom of the funnel, vertically into the centre space if there is no wind, and at an angle increasing

Table accompanying Mr. Rogers Field's Letter on Difference of Rainfall with Elevation.

Date.	Direction of Wind.	Force of Wind.	Depth of Rain in inches.					Ratios. Rain on Ground = 100.			
			Ground Gauge.	S.E. Tower Gauge.	S.W. Tower Gauge.	N.W. Tower Gauge.	N.E. Tower Gauge.	S.E. Tower Gauge.	S.W. Tower Gauge.	N.W. Tower Gauge.	N.E. Tower Gauge.
1878. Jan. 4	S. to E.	Not much	·123	·089	·113	·121	·105	72	92	98	85
May 10 & 11	E. to S.E.	Not much	·341	·303	·330	·335	·313	89	97	98	92
June 14	E. to E.S.E.	Very light	·444	·346	·380	·406	·359	78	86	91	81
MEAN	S.E.	Light .....	...	...	...	...	...	79	92	96	86
Feb. 13	S.	Strong	·072	·059	·055	·078	·091	82	76	108	126
Feb. 27	S. to S. by W.	Rather strong	·198	·138	·149	·198	·202	69	75	100	102
May 13	S.S.E. to S.S.W.	Light to fresh	·296	·275	·282	·302	·292	93	95	102	99
May 17	S.	Very strong	·096	·024	·044	·104	·107	25	46	108	111
May 22	S.	Moderate to strong	·346	·328	·341	·354	·344	95	98	102	99
MEAN	S.	Strong .....	...	...	...	...	...	73	78	104	107
1877. Dec. 28 ...	S. to S.S.W.	Moderate	·425	·301	·349	·385	·416	71	82	91	98
1878. Jan. 3 & 4. ...	S. to S.S.W.	Strong	·203	·130	·152	·212	·216	64	75	104	106
Jan. 28	S. to S.S.W.	Strong	·104	·088	·098	·117	·122	84	94	113	117
Feb. 28 & March 1	S.S.W.	Violent	·134	·086	·107	·131	·129	64	80	93	86
April 3	S.S.W. to S.W.	Moderate	·209	·174	·188	·216	·220	83	90	103	105
MEAN	S.S.W.	Strong .....	...	...	...	...	...	73	84	102	104
April 5	W.S.W.	Not much	·130	·106	·116	·119	·123	82	89	92	95
May 26 & 27	S.W. to S.W. by W.	Moderate	·248	·221	·257	·241	·236	89	104	97	95
June 4	S.W. by W.	Good bit	·058	·050	·054	·055	·054	86	93	95	93
June 19	S.W. to W.	Very light	·502	·451	·457	·478	·441	90	91	95	88
MEAN	W.S.W.	Moderate .....	...	...	...	...	...	87	94	95	93
April 20	W.	Very light	·242	·232	·218	·224	·229	96	90	93	95
June 7	W.	Slight	·019	·020	·016	·018	·019	105	84	95	100
MEAN	W.	Light .....	...	...	...	...	...	101	87	94	98
Jan. 26	N.W.	Very piercing	·027	·018	·012	·011	·020	67	44	41	74
Jan. 28, 12 to 2 pm	N.W.	Calmed down	·091	·080	·071	·073	·072	88	78	80	79
June 16	N.W.	Scarcely any	·157	·141	·137	·140	·130	90	87	89	83
MEAN	N.W.	Light .....	...	...	...	...	...	82	70	70	79
Feb. 11	N.E.	Very little	·049	·045	·049	·046	·043	92	100	94	88
May 29	N.N.E.	Blustering	·053	·048	·049	·042	·039	90	93	79	74
June 30	N.N.E.	Violent	·436	·368	·378	·368	·246	84	87	84	56
MEAN	N.E. by N.	Strong .....	...	...	...	...	...	89	93	86	73
Jan. 5	E. to E.N.E.	Moderate	·082	·060	·073	·079	·069	73	89	96	84
April 10	E.N.E.	Strong to moderate	1·359	·984	1·103	1·170	1·004	72	81	86	74
April 24	N.E. by E.	Light	·078	·059	·057	·059	·055	77	73	77	70
MEAN	E.N.E.	Moderate .....	...	...	...	...	...	74	81	86	76
Feb. 9 .....	...	Really none	·054	·054	·061	·066	·066	100	113	122	122
Feb. 10	S. to S.E.	Very little	·015	·012	·019	·019	·020	80	127	127	133
April 16	S. to E.	Scarcely any	·057	·048	·056	·059	·055	84	98	104	96
April 20	S.W. to W.	Scarcely any	·216	·230	·232	·234	·233	106	107	108	108
June 5	N. to W.	Practically none	·061	·061	·063	·063	·061	100	103	103	100
MEAN .....	...	Calm .....	...	...	...	...	...	94	110	113	112

with the force of the wind, and, of course, into the compartment furthest from the direction whence the wind is coming.—Ed.]



THUNDERSTORM AND WHIRLWIND.

To the Editor of the Meteorological Magazine.

SIR,—During the second thundery period experienced this summer we were favoured in this district with a fair, but not, as in the first period, with an undue share of thunder and hail storms. Only one of these was sufficiently remarkable to prove of interest to your readers.

The morning of June 26th was totally cloudless, but about noon a few fragmentary high cumuli began to be scattered over the sky, travelling from S. by W., from which quarter there was a very hot dry breeze. About 1 p.m. the cumuli rose to a large size in the W., and continued steadily to increase. At 3 p.m. it began to thunder in the W. (distant), in which quarter a large nimbus had formed. This storm was accompanied, as I am informed, by a very strong gusty wind at Worcester and Birmingham, where it was felt rather heavily. At this place the breeze at that hour had died down; cumulus travelled slowly from S., and cirrus, which began to be visible above, from N.N.E.

At 4 p.m. a large cumulus slowly formed about three miles to the

S. of this place, beyond which a new range of nimbus was visible. This cumulus became steadily larger and darker, and when nearly overhead emitted some flashes of lightning. A very loud roaring sound could now be heard in the cloud, and at 4.25 it began to hail very heavily. The wind suddenly rose and went twice completely round the compass in about ten minutes, blowing, especially from the S., with extreme violence, and scattering branches of trees all over the meadows. The tornado was accompanied by a deluge of rain and hail. At 4.50 the nimbus had passed off to the N., and had apparently become less intense. At 5 p.m. the sun shone out, and we had a dead calm. At that hour it was thundering incessantly in S.E. and S., and this fresh storm was accompanied in the neighbourhood of Rugby (as appears from a cutting from the *Midland Times*, which I enclose) by a tornado similar to that which we had experienced.

The last mentioned storm passed over this place attended by a strong S.S.W. gust and some vivid lightning, at 5.40. After this we had a steady breeze from E. throughout the evening, with rain and occasional thunder in the E and N.E. The barometer was very steady and high during the storms.—Yours truly,

W. CLEMENT LEY.

Ashby Parva Rectory, Lutterworth, July 12th, 1878.

LONG LAWFORD.

THUNDERSTORM.—About five o'clock on Wednesday afternoon this village and neighbourhood were visited by a storm of a most alarming nature, such as had never been witnessed by the "oldest inhabitant." The day had been extremely hot, and towards the afternoon dark clouds appeared in the horizon; about five o'clock a few drops of rain began to fall, and suddenly without any further warning, the storm burst in all its fury, the wind blowing a hurricane, the rain falling in a perfect deluge, and to add to the terrors of the scene the lightning was awfully grand, followed by loud and crashing peals of thunder. Branches of trees were torn off and whirled about in all directions, many large trees that had withstood scores of previous storms were torn up by the roots, and people were in fear lest their houses should also be demolished. Many gardens suffered severely, fruit trees being broken, and the peas, beans and potatoes being laid flat by the terrific force of the wind and the weight of the falling water. During the storm hail stones of large size fell, and broke several windows. Persons working in the hay-fields were exposed to the full fury of the elements and dare not run beneath the trees for shelter as they were being blown down in all directions, and many hair-breadth escapes are reported. A cow belonging to Mr. Burnham was so much injured that it had to be killed, but this is the only injury to life or limb that we have heard of, although the damage to property was very great. Scores of trees were blown down, and hundreds more or less injured. Near to Holbrook Grange, no fewer than 16 large trees were uprooted, to say nothing of smaller ones, and others dismembered of many of their branches, the plantations suffering severely, and the damage here is estimated at not less than £100. At Mr. Spokes's, at Little Lawford, several windows were broken and other damage was done. The storm appears to have been limited in extent, as it did not reach so far as Dunchurch station, and at Bretford but little rain fell, but we are informed that a chimney of a house there was struck by lightning. The electric fluid also struck two trees near to Brinklow. The storm, which lasted about half-an-hour, will be long remembered, and in some places its disastrous effects will be visible for years to come.—*Midland Times*.

LARGE HAIL.

To the Editor of the Meteorological Magazine.

SIR,—I fear that there is no good record of the below mentioned storm at Newport, Isle of Wight, which occurrence I well remember. I have a strong idea that my father measured a hail-stone *nine inches* in circumference. The following is from the *Hants Independent* of August 25th, 1855 :—

“The most terrific storm we ever witnessed broke over the town and suburbs on Thursday night (23rd), shortly after 11 o'clock, when the elements pelted down upon us for nearly half-an-hour pieces of jagged ice measuring from 3 to 7 inches in circumference, and fully as large as hens' eggs; the consequence of which is that scarcely a house within the scope of the tempest has escaped injury either to its glazing or covering; and the garden crops of fruit, vegetables, and flowers, are beaten into the earth in one universal ruin; the birds at roost in the trees were killed by hundreds; plates of glass $\frac{1}{4}$ -of-an-inch in thickness were shivered in the storm, as if they were but egg shells; and in some conservatories, not a single pane or plant remains entire. In short, such devastation, and such a complete destruction of property, were never before witnessed, even by the 'oldest inhabitant.'”

In this year of thunderstorms, I am induced to send you the above, as I do not remember anything approaching to it for grandeur, or for the amount of destruction caused. I *believe* even sheep were killed by the hail; and I *think* my father stated that it drifted like snow into heaps 12 or 18 inches deep. The hail, of course, was of all sizes. At Ventnor there was no measurable quantity of rain.—Sincerely yours,

E. G. ALDRIDGE.

3rd July, 1878.

YET ANOTHER HEAVY RAIN.

To the Editor of the "Times."

SIR,—In six years out of the last 20 there was no day on which the fall of rain amounted to one inch. During the 20 years 1858 to 1877 the rainfall

On 21 days exceeded ... 1'00 in.	On 4 days exceeded ... 1'50 in.
On 11 days exceeded ... 1'10 „	On 3 days exceeded ... 1'60 „
On 9 days exceeded ... 1'20 „	On 1 day exceeded ... 1'70 „
On 6 days exceeded ... 1'30 „	On 1 day exceeded ... 1'80 „
On 5 days exceeded ... 1'40 „	

And 1'82 in. on July 25th, 1867, was the largest fall in a true rainfall day.

The number and largeness of the heavy falls in 1878 were not only unusual when I last addressed you, but they were beyond all precedent, and now another has to be added to the list. I accidentally omitted to quote one in my last letter, and therefore now give the full series for 1878, which is as follows :—April 10th, 2'56 in. (this was the fall in the rainfall day, the total was 3'23 in.); May 7th, 1'71 in.; June 23rd, 3'28 in. (the whole of this fell in one hour and a half); June 30th, 1'13 in. (this fell in six hours); August 3rd, 1'41 in. Comparing these five falls in the one year 1878 with the above table for 1858–77, it will be seen that in the present year we have had two days each with larger falls than any day for 20 years, one day (May 7th) which has only been ex-

ceeded once in 20 years, another (August 3rd) which has had but five precedents in 20 years, and even the least (June 30th) has only been exceeded ten times in that period. Both in quantity and frequency the falls in 1878 are far beyond any precedent at this station.

The fall of August 3rd was chiefly produced by two storms. The first began at 10.25 a.m. on the 3rd, rapidly became heavy, yielded 0.32 in. by 11 a.m., and 0.44 in. by noon, when it ceased. Some short showers afterwards brought the fall up to 0.53 in. At night lightning was seen from 11.30 p.m., and thunder heard shortly after midnight. Rain began about 0.30 a.m. on the 4th, and by 0.45 was very heavy; by 1 a.m. a quarter of an inch had fallen, and by 1.25 a second quarter of an inch; it then rained less heavily, only 0.09 in. falling in the next half hour; the fall after 2 a.m. was 0.29 inch. The night storm therefore gave 0.88 in., which added to the day fall of 0.53 in., gives the large total of 1.41 in. for the 24 hours.

I have not yet received particulars of the fall at other stations, but I think it very probable that others felt this storm more than we did here.

I am, Sir, your obedient servant,

62, Camden Square, N.W.

G. J. SYMONS.

P.S.—There was almost constant thunder on the 4th from 1 to 3 p.m., from 4.13 to 6.38 p.m., and about 7.40 p.m., and a few sharp showers, especially one which gave 0.13 in. between 6.32 and 6.34.30 p.m., *i.e.*, in $2\frac{1}{2}$ minutes.

HEAVY RAINS AT HITCHEN SINCE 1851.

To the Editor of the Meteorological Magazine.

SIR,—I see you were up and doing last night. I send you all our records of heavy rain (1.00 in. and more) that have fallen since June. 1849. As a rule July is the month (shown in table in black figures.) The rainfall of 1857 was curious.

	in.		in.		in.
1852...Jan. 13	1.10	1857...Oct. 23	3.09	1865...Oct. 23	1.25
„ „ „ 14	1.02	„ „ „ Nov. 4	1.18	1867...May 10	1.13
„ „ „ May 27	1.00	1858...April 9	1.16	1868...Aug. 19	2.22
„ „ „ June 10	1.00	„ „ „ July 11	1.08	1871...July 10	1.15
„ „ „ July 14	1.09	„ „ „ Aug. 15	1.48	„ „ „ Sept. 29	1.38
„ „ „ Oct. 5	1.00	1859...July 30	1.08	1873...July 13	1.24
1853...July 14	1.82	1860...May 13	1.40	1874... „ 10	1.62
1855... „ 12	1.31	„ „ „ June 3	1.14	1875... „ 3	2.06
1856...Sept. 2	1.08	„ „ „ Sept. 25	1.40	1876...Sept. 5	1.12
1857...June 20	1.00	1861...Nov. 14	1.33	„ „ „ Dec. 23	1.05
„ „ „ July 28	1.22	1864...Mar. 1	1.04	1877...Sept. 3	1.04
„ „ „ Aug. 6	1.15	1865...July 7	1.42	„ „ „ Nov. 11	1.31
„ „ „ 14	1.32	„ „ „ 10	1.05	1878...May 7	1.05
„ „ „ 15	1.31	„ „ „ Aug. 24	1.35	„ „ „ Aug. 4	1.13
„ „ „ Oct. 9	1.08	„ „ „ Oct. 17	1.68		

A furious thunderstorm took place here yesterday (August 4th) at 7 p.m. In less than 10 minutes we registered 0.66 in.; the remainder (0.47 in.) fell between 9 and 10 p.m. During the 10 minutes the thermometer fell nearly 7°, and the lawn was white with hail. At Orton Head they had only 0.92 in.; the storm came from the S.E., and followed a storm that just missed us by a mile travelling in the same direction. These falls are so local that whilst Stevenage (4 miles off), on Saturday was swimming with water, half-a-mile out of the village, they had not had a drop.—Yours truly,

W. LUCAS.

Hitchin, August 5th, 1878.

RAINFALL IN JULY.

To the Editor of the Meteorological Magazine.

SIR,—Thinking you may be somewhat interested in the very small rainfall here during the month of July, I have copied it from my weather book. The total fall is only .04 in. for the whole month, .03 in. fell on the 22nd, and .01 in. on the 23rd. There were other times when a drop or so of rain fell, but not sufficient for observation in the rain gauge.

The above is the smallest amount of rainfall that I have recorded since I have kept a register, now upwards of twenty years. I find in September, 1865, I have registered only .18 in. for that month, when the weather was remarkably fine, and 21 cloudless days.

We have rain to-day (.16 in.). I ought to say that on the 30th June this year we had the skirt of a heavy shower (say .18 in.), but within a mile from here I should think three times that quantity fell. The rainfall on the 23rd June here was only .03 in., when you registered upwards of 2 inches at Camden Town.—Yours truly,

S. TABOR.

Fennes, near Braintree, 3rd August, 1878.

WHIRLWIND IN CORNWALL, JUNE 9TH.

SINGULAR STORM.—A storm of an extraordinary character visited a part of Cornwall early on Sunday morning. At Golant, near Fowey, the storm was accompanied by heavy rain. Houses were unroofed, some of the slate stones being carried a distance of 500 yards. In one orchard 20 or 30 apple trees were blown down, in another 15, and several others have been more or less damaged. In Penquite Wood, the property of Mr. West, of St. Blazey, there are 10 large oak trees rooted out of the ground, some of the limbs falling across the Lostwithiel and Fowey Railway. Telegraph wires were carried away, and some of the posts stuck four or five feet in the mud. Branches of trees were floating all over the river. The wind was so strong that it blew down about 300 feet of the new wood railing by the side of the line. The most remarkable incident, however, occurred to a large boat, 2½ tons burthen. This boat, which was lying in an upright position on her keel on the beach, was turned over bottom upwards and carried a distance of 12 feet, breaking in her starboard quarter. The storm, which lasted only about five minutes, came from the south-west, and seems to have been confined to a small space, as some houses quite close to those damaged received no injury at all. Such a wreck of property has never before been witnessed in the village. It is a miracle no lives were lost, as a great many trees fell near dwelling houses. The storm appears to have been confined to the Fowey River and its neighbourhood. At Lerryn, Couched Mill, about three miles from Lostwithiel, up the River Fowey, the mischief done was considerable. The little village is surrounded by orchards, and upwards of 300 apple trees were uprooted. Large oak, elm, and other trees, were also uprooted. The damage done to house property was also great, houses being entirely stripped of their roofs, and chimneys being blown down, but, happily, no one was injured. In the little village of Couched Mill, about one mile from Lerryn, it also raged with great fury, doing considerable damage to the orchards and house property. Mr. Isabell, who owns a large mill, at Couched Mill, was awake at the time, and says that he heard something coming up the valley roaring like a heavy peal of thunder. He got up

and looked out of the window, and for about three minutes, he says, the lightning was awful. He saw wood which he had stacked blowing about as if it was paper. Some pieces which had been cut for barrel staves were afterwards found more than a mile away, at which distance they broke the window of a farmhouse. The storm was very remarkable, for it only seems to have been about 20 yards wide, and lasted but three or four minutes.

SUPPLEMENTARY TABLE OF RAINFALL IN JULY, 1878.

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

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	·65	XI.	Solva	3·80
„	Littlehampton	·49	„	Castle Malgwyn	2·39
„	Hailsham	·83	„	Nantgwilt, Rhayader	1·36
„	St. Lawrence, I. of W....	3·54	„	Carno	·58
„	Strathfield Turgiss	·88	„	Rhug, Corwen	·79
III.	Addington Manor	·86	„	Port Madoc	·62
„	Oxford	1·17	XII.	Carsphairn	·45
„	Northampton	·45	„	Melrose	1·03
„	Cambridge	·97	XV.	Gruinart	1·09
IV.	Sheering	2·05	XVI.	Grandtully .....	...
„	Diss	1·67	XVII.	Tomintoul	1·14
„	Swaffham .....	...	„	Keith	2·04
V.	Alderbury, Salisbury ...	1·79	XVIII.	Dalwhinnie	1·15
„	Compton Bassett	2·82	„	Auchnasheen	3·00
„	Dartmoor	2·41	„	Springfield, Tain	1·25
„	Teignmouth	1·54	„	Glenfinnan	4·62
„	Laugtree, Torrington ..	1·92	XIX.	Watten	2·44
„	Cosgarne, St. Austell ...	1·55	XX.	Glenville, Fermoy	2·82
„	Taunton	2·76	„	Tralee .....	...
VI.	Bristol	2·89	„	Tipperary	1·84
„	Sansaw .....	...	„	Newcastle W., Limerick	2·25
„	Cheadle	1·76	„	Kilrush	·78
„	Rickenhill Vicarage .....	...	XXI.	Kilkenny .....	...
VII.	Coston, Melton Mowbray	1·43	„	Kilsallaghan	1·00
„	Bucknall	1·50	„	Twyford, Athlone	2·03
VIII.	Walton, Liverpool	1·05	„	Belvedere, Mullingar ..	1·88
„	Broughton-in-Furness ..	·73	XXII.	Ballinasloe .....	...
IX.	Stanley, Wakefield	1·01	„	Kylemore	2·23
„	Mickley, Ripon	·66	„	Carrick on Shannon	1·98
„	Whitby .....	...	XXIII.	Rockcorry	·92
X.	Gainford	·49	„	Warrenpoint	·50
„	Unthank Hall	1·70	„	Newtownards	1·13
„	Shap	·73	„	Bushmills	1·46
IX.	Llanfrechfa	1·35	„	Buncrana	·47

THE WEATHER IN JULY.

THE weather at the beginning of July was much more unsettled than during the last week of June. Pressure from the 1st to the 4th was lowest to the eastward and southward of our Islands, so that N. and N.E. breezes prevailed, bringing cloudy skies and cold weather to all coasts; the thermometric maxima on the 3rd being as much as 30° lower than those on the previous Wednesday. From the 4th to the 7th the highest readings of the barometer were found over France, and depressions passed from W. to E. to the northward of our Islands, occasioning first south-westerly, then westerly, and finally north-westerly breezes.

During the second week quiet, cool and cloudy weather was experienced. Showers of rain fell in several places on the 7th, 9th and 10th, and a good deal of rain over our south-western counties on the night of the 12th, but otherwise the weather was dry generally. The barometer was generally highest to the S.W. of our Islands, and lowest in the north. Various shallow depressions passed across in the extreme north, especially on the 9th and 10th, and a very small one passed in a south-easterly direction near the S.W. of Ireland on the 12th, and at 8 a.m. on the 13th it was off the mouth of the Channel.

After the 13th the weather underwent a very marked and favourable change, from the comparatively cool and cloudy period above to one of brilliant sunshiny weather, with very high temperatures and no rain. The hottest day of all was Friday, the 19th, on which occasion the thermometer rose to 91° in the shade at Nottingham, to 88° in London, and to between 91° and 100° in the west of France. On the 17th the barometer began to fall in the S.—a fall which on the following days became nearly general, and at the close of the third week it appeared that the fine weather had begun to break up throughout the greater part of Western Europe. Severe thunderstorms occurred in the S.W. and S. of our Islands, with a singular absence of rain.

On the 23rd the reports showed the weather to be in a very changeable state. The barometer had risen rather briskly in the Shetlands and W. of Norway. Local irregularities in pressure were noticeable in many places, indicating unsettled thundery weather. The next day pressure was increasing briskly in Sweden, and recovering somewhat on our S.W. coasts, but was decreasing elsewhere. This changeable weather continued on the 25th and following days to the 28th. On the 25th the distribution of pressure was somewhat peculiar. Low readings prevailed to the north-westward of our Islands, from which region a band of low pressure extended south-eastwards over Great Britain. In this band the barometer varied from 29.62 in. to 29.69 in., whilst over the Bay of Biscay readings as high as 30.00 in. were reported, and 29.85 in. over Norway and Denmark. Local irregularities were still prevalent. Thunderstorms and heavy rain occurred in many parts of England and Ireland. The largest falls reported are 2.2 in. at Nottingham, 0.9 in. at Donaghadee, 0.8 in. at Liverpool, and 0.7 in. at Oxford. The maximum temperatures on this day in England varied from 70° to 75° .

On the 28th the weather again became fine in the S.E. and N.W., and also in Sweden, but was cloudy in all other parts of Western Europe. Heavy rain was reported from York, Valencia and Roche's Point, and thunderstorms from Nottingham and Dover. On the 30th pressure was increasing over the whole of Western Europe, most on our north-east coasts. The next day, however, a decrease was reported both from Toulon and the Baltic, but in all other places it was rising. A large anticyclone (30.30 in. and upwards) lay over the British Isles, whence readings decreased to 30.00 in. at Wisby and 29.86 in. at Toulon. The weather was exceedingly fine over Sweden, Denmark, the whole of the western and northern parts of our Islands and the greater part of France, but over the Netherlands and the east and south-east of England the sky was overcast and, in some places, gloomy. No heavy rain was reported, and the sea was smooth throughout Western Europe.

H. E. M.

JULY, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which .01 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Deg.		Date.	Deg.	Date.			
				Dpth.	Date.								
											inches.	in.	
I.	Camden Town .....	.64	- 1.15	.28	24	7	86.2	19	43.5	4	0	0
II.	Maidstone (Hunton Court)...	1.74	+ .10	.63	27	8	...	...	...	...	...	...
III.	Selborne (The Wakes).....	2.40	+ .20	.51	23	8	80.0	20	41.5	4	0	0	
III.	Hitchen	1.20	- .70	.36	24	8	79.0	19	42.0	3	0	...	
IV.	Banbury	1.51	- .55	1.06	24	10	83.0	19§	45.0	30	0	...	
IV.	Bury St. Edmunds (Culford)...	.69	- 1.30	.39	24	8	87.0	19	37.0	3	0	0	
V.	Norwich (Sprowston).....	.53	...	.22	29	7	...	...	...	...	...	...
V.	Bridport	1.96	- .15	.64	12	10	...	...	...	...	...	...
V.	Barnstaple	1.70	- 1.16	.79	12	11	87.0	20	53.0	31	0	...	
V.	Bodmin	1.96	- 1.15	.67	12	11	83.0	19	51.0	1	0	0	
VI.	Cirencester .....	.92	- 1.52	.38	24	6	...	...	...	...	...	...
VII.	Shifnal (Haughton Hall) ...	1.30	- .87	1.07	24	7	79.0	20*	45.0	4	0	0	
VII.	Tenbury (Orleton) ...	2.16	- .22	1.47	24	8	85.7	17	41.2	4	0	0	
VII.	Leicester (Town Museum) ...	2.04	...	1.21	24	8	84.0	21	42.9	4	0	...	
VIII.	Boston	1.20	- 1.10	.39	27	11	85.0	20	45.0	13	0	...	
VIII.	Grimsby (Killingholme) .....	.65	...	.33	29	11	80.5	18	45.0	4	0	...
VIII.	Mansfield	1.08	...	.40	27	9	83.2	19	41.9	4	0	0
VIII.	Manchester (Ardwick).....	1.28	- 1.25	.36	24	9	88.0	21	50.0	13	0	...	
IX.	York .....	...	...	...	...	...	...	...	...	...	...	...
IX.	Skipton (Arncliffe)	2.25	- .98	.80	25	12	93.0	22	42.0	12	0	...	
X.	North Shields .....	.13	- 1.68	.04	6, 28	7	80.0	18	47.0	3	0	...
X.	Borrowdale (Seathwaite)	3.11	- 5.03	1.60	5	8	...	...	...	...	...	...
XI.	Cardiff (Crockherbtown) ...	2.01	...	.78	23	9	84.6	21	48.0	28	0	...
XI.	Haverfordwest	4.80	+ 1.50	2.86	19	9	84.3	19	46.0	27||	0	...	
XI.	Aberdovey	1.41	...	.58	24	11	92.0	20†	48.0	13	0	...
XI.	Llandudno	1.19	- 1.10	1.05	24	4	13.6	23	46.9	13	0	...	
XII.	Dumfries (Crichton Asylum)...	.47	- 2.06	.27	6	3	85.5	22	42.5	31	0	...	
XII.	Hawick (Silverbut Hall) ...	.84	...	.37	26	7	...	...	...	...	...	...
XIV.	Glasgow (Cessnock Park) ...	.45	...	...	...	...	70.0	...	40.0	...	0	...
XVI.	Mull (Quinish)	1.74	...	.57	5	14	...	...	...	...	...	...
XVI.	Loch Leven .....	...	...	...	...	...	...	...	...	...	...	...
XVI.	Tyndrum (Ewick) .....	...	...	...	...	...	...	...	...	...	...	...
XVII.	Arbroath .....	.73	- 1.82	.26	11	7	84.0	18	45.0	2	0	...
XVII.	Braemar .....	.43	- 1.85	.12	7	7	81.5	21	38.4	4	0	...
XVII.	Aberdeen .....	...	...	...	...	...	...	...	...	...	...	...
XVIII.	Gairloch	3.20	...	.71	5	18	...	...	...	...	...	...
XVIII.	Portree	2.54	- 3.53	.59	4	17	...	...	...	...	...	...
XVIII.	Inverness (Culloden) ...	1.59	- 1.08	...	...	11	74.7	21	45.0	4	0	0
XIX.	Dunrobin	1.27	- .48	.65	4	10	74.5	16	41.0	4	0	...	
XIX.	Sandwick	2.52	+ .63	1.15	5	12	65.1	31	46.3	3	0	0	
XX.	Caherciveen Darrynane Abbey	2.43	...	.60	27	13	...	...	...	...	...	...
XX.	Cork	1.51	...	.50	26	6	...	...	...	...	...	...
XX.	Waterford .....	.88	- 2.44	.50	12	2	...	...	...	...	...	...
XX.	Killaloe	1.42	- 1.77	.35	23	8	90.0	23	44.0	5	0	...	
XXI.	Portarlinton	1.27	- 2.27	.77	23	16	80.5	20	45.0	28	0	...	
XXI.	Monkstown, Dublin .....	.55	- 1.88	.23	26	6	...	...	...	...	...	...
XXII.	Galway	1.43	...	.66	23	9	85.0	23	48.0	4, 25	0	...
XXIII.	Waringstown .....	.51	...	.38	24	4	84.0	22	44.0	12	0	...
XXIII.	Edenfel (Omagh) .....	.37	...	.09	9	10	81.0	22†	39.0	29	0	...
XXIII.	Ballyshannon	2.04	...	1.37	23	7	...	...	...	...	...	...

* And 21. † And 21, 22. ‡ And 23. || And 28. § And 20, 21.

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

METEOROLOGICAL NOTES ON JULY.

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.—A growing month, very promising for the harvest; all the cereal crops in fine condition; hops doubtful. T on the 22nd, 23rd and 24th.

BANBURY.—Wheat much beaten down by the R of the 24th; a little cut at the end of the month. TS on the 24th and 26th.

CULFORD.—An almost entire absence of R was experienced here during the first three weeks of the month, the total rainfall of which was less than three quarters of an inch (.69 in.); fortunately, however, many days were overcast and sunless. A few very warm days followed the 17th, the max. temperature occurring on the 19th; the mean temperature was 61°·4, and easterly winds prevailed during only 5 days. TS on 24th.

BODMIN.—Mean temp. of the month (67°·6) considerably above the average.

SHIFNALL.—The hot weather with which the last month ended continued at the beginning of this, producing real dog days up to the 24th, when it was broken up by a severe TS with a heavy downfall of R (1·07 in.) commencing at 5 p.m., and lasting all night, lowering the temperature from 72° to 65°. The storm only cleared the air for further heat, tempered however by a pleasant breeze on most days from E. and N.E. Hay crop abundant and well got in; grain crops vastly improved. Scarcely a butterfly, not even a white one, seen since May till the 24th of this month.

TENBURY.—The temperature was generally rather low, with much cloud till the 15th, when the weather became very fine, hot and dry, and continued so till noon on the 22nd, when the first heavy R occurred with T and L. On the 24th distant T commenced at 3 p.m., becoming louder with heavy R at 4.15 p.m.; frequent showers fell till 9 p.m., and then very heavy R at intervals till 8 a.m. on 25th, by which time 1·47 in. had fallen in about 18 hours; after the 26th the weather was fine, dry and warm to the end of the month. The mean temp. was about 1° above the average of the month, and the weather was very favourable for the hay harvest and the ripening of the corn.

LEICESTER.—T on the 23rd and 24th; TS on the 25th, between 6 and 7 p.m.

BOSTON.—The long spell of dry weather, which lasted from the beginning of June, broke up on the 22nd, and for the next week we had constant showers, which were most beneficial to the newly-sown turnip, radish, and mangold crops. Some of the heaviest wheat crops have been beaten down by the rain, but generally the corn is standing well up, and there is every prospect of a good harvest; reaping will begin generally in about a week or ten days.

GRIMSBY.—A fine summer month, warmer than the average, and some days very hot; but rain, which fell abundantly at times around us, was much wanted here. End of month cloudy, T and L on 24th and 25th, T on 28th.

MANSFIELD.—TS on the 24th, at 4 p.m., and also on the 27th, at 4 p.m.

ARNcliffe.—A higher temperature and less rainfall have never been registered at this station in July. Hay harvest abundant and well secured.

NORTH SHIELDS.—A very fine month, with scarcely any R.

SEATHWAITE.—Rainfall not half the average. T and L on 21st.

WALES.

HAVERFORDWEST.—A splendid month with high temperature, large amount of sunlight and plentiful R at intervals. Magnificent hay crop and splendid promise of a good cereal harvest. On the evening of the 19th one of the severest storms took place that I ever remember; the heat had been intense for several days, and especially so in the early part of this month. T was heard in a south-easterly direction about 5 p.m.; large masses of cumuli of a dark and lurid colour occupied the easterly horizon; the air was sultry in the extreme; at 10 p.m. vivid flashes of sheet L occurred incessantly, but it was not till near midnight that the first mutterings of the great storm were heard; the T became louder, the L flashed without a moment's pause, every variety of form and colour of flash, pale rose, steel blue, intense white, some zigzag, some spiral;

the noise of the T was very awful, the peculiar sound as of air rushing in to fill up a vast vacuum being very suggestive and dreadful. R commenced about 1 a.m. and continued with but little intermission till about 4.30 a.m., the amount up to that time being 2.86 in. In the lower parts of the town the basements of the houses were flooded, and great damage was done to property; the vane of St. Thomas's church was struck, and a hole made through the groined roof of the tower; the belfry of another church was also struck, several houses were shattered, telegraph posts split to pieces, a cow and a horse killed, and other cattle killed or injured in the surrounding district, fine trees split from the top to the roots, haystack fired, and one man killed.

ABERDOVEY.—A very dry, hot month; with two or three days' exception, generally calm and cloudless, wind ranging from N.W. to E. T and L on 20th, accompanied by hailstones as large as pigeons' eggs. Splendid harvest weather.

LLANDUDNO.—A month of splendid weather, the mean temp. being half a degree above, and the rainfall about one inch below the average. Hay harvest most abundant, concluded before the end of the month, and the grain harvest begun. A fine seasonable R on 24th, fully 1 in. in 24 hours. T on 24th at 2 p.m.

SCOTLAND.

DUMFRIES.—The rainfall for July is the lowest every recorded at this station, and the mean temp. is exceptionally high; the winds have been very light, and chiefly from N.E. and N.W. Neither T nor L have been recorded, which is very unusual considering the extreme heat.

HAWICK.—The finest July seen here for many years. Hay crop secured in splendid condition. Pastures are now much parched, and will take a good deal of R to moisten them properly. T on 19th and 23rd.

QUINISH.—Broken showery weather from 5th to 11th inclusive. A slight R continuously from 16th to 21st, the rest of the month very fine and hot.

ARBROATH.—The max. temp. in the shade, 84°, is the highest temp. registered at Arbroath for at least thirty-five years.

BRAEMAR.—A very dry month; temp. considerably above the average, crops and pastures suffering much in consequence.

PORTREE.—A fine month, the rainfall much under the average; from the 18th very warm, with bright sun. Potatoe blight is making its appearance.

INVERNESS.—T about 2 p.m. on the 25th.

DUNROBIN.—This month on the whole has been dry and fine. Vegetation began to suffer for want of R by the close of the month; pastures and crops on some light lands suffered severely.

SANDWICK.—July has been a fine month, R rather above the average, but nearly four-fifths of it (1.90 in.) fell on the 4th, 5th, and 6th; it has also been warm and very favourable for the crops, particularly for haymaking.

IRELAND.

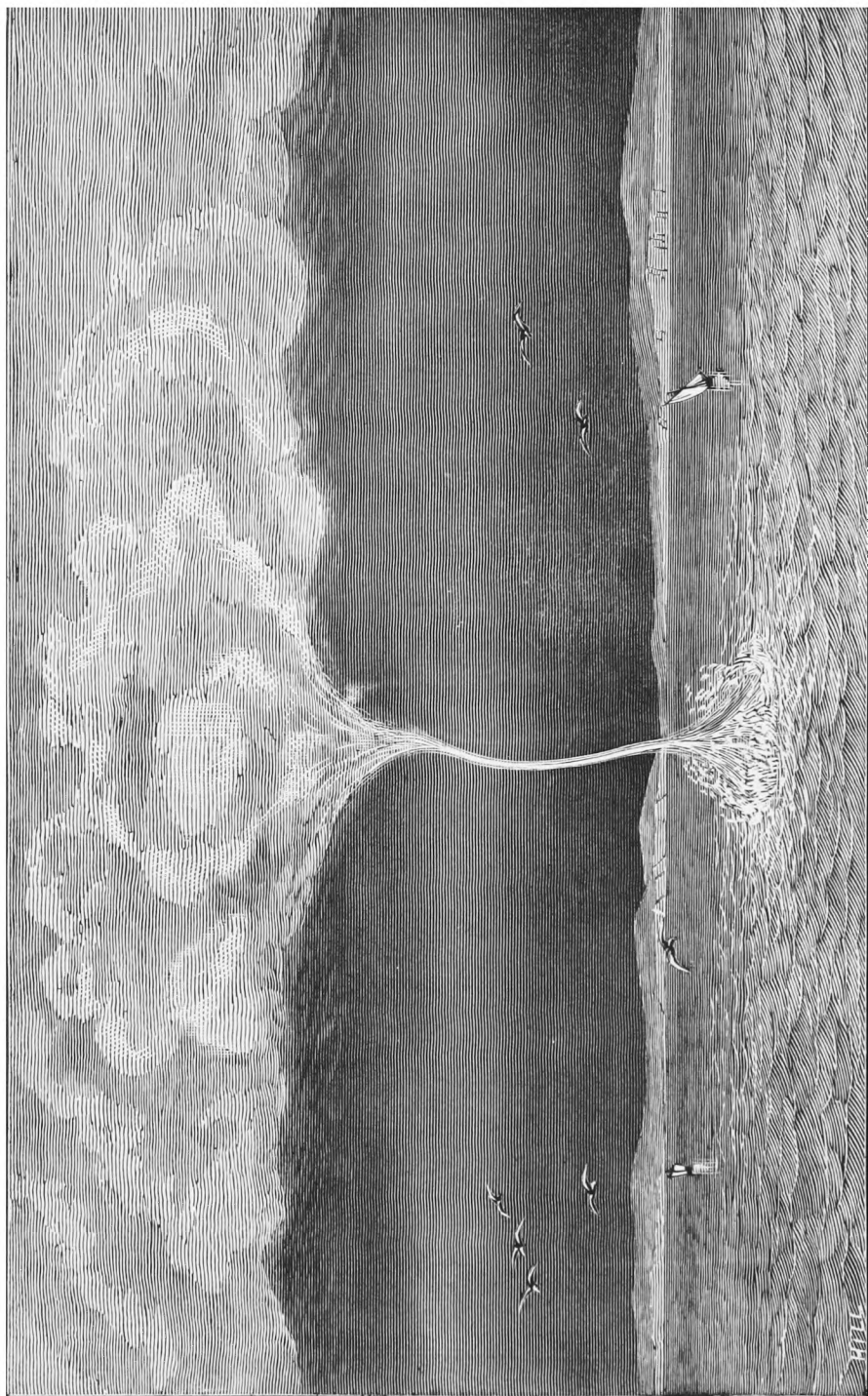
DARRYNANE ABBEY.—The first month of real summer that we have had; heavy but distant T on the 20th and again on the 21st with some L. This latter storm was very heavy at Waterville and Ballinskelligs, 5 to 8 miles to N.W., and accompanied by heavy R.

KILLALOE.—An extraordinary fine month with most beneficial results in every agricultural department, particularly haymaking, one of the finest crops ever made in Ireland being now secured. Potatoe crops also much improved.

MONKSTOWN.—One of the driest and warmest Julys for many years.

EDENFEL, OMAGH.—A most seasonable month; the third week hotter than any corresponding period since 1868; crops of all kinds most luxuriant.

BALLYSHANNON.—The month has been one of unusual heat. On the 23rd, at 6 p.m., a severe TS with frequent L broke over this town and neighbourhood, the R fell in torrents, and from 6.30 p.m. to 7.20 p.m. the rainfall was .60 in., and up to 9 a.m. on the following morning the total amount was 1.37 in. This storm was in a great degree local, as in a town 11 miles to the N. it was not felt, nor in a neighbouring county. All crops are good, and the potatoes, though not free from blight, promise abundantly.



WATERSPOUT AS SEEN OFF RYDE PIER, AUGUST 21ST, 1878.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLII.]

SEPTEMBER, 1878.

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THE BRITISH ASSOCIATION AT DUBLIN.

ALTHOUGH taken generally the meeting was a great success, we cannot regard it as such in its meteorological features, and this applies both to the actual weather during the meeting, and to the communications upon meteorology. Of the latter there were only nine, of which the following are the titles :—

- Prof. Everett*, Report of the Committee on Underground Temperature.
Prof. G. Forbes, Report of the Committee on Atmospheric Electricity.
James Glaisher, F.R.S., Report of the Committee on Luminous Meteors.
G. J. Symons, F.R.S., On the Rainfall of Ireland.
S. P. Thompson, On certain Phenomena accompanying Rainbows.
W. Morris, On the Temperature of the Earth within.
C. Meldrum, F.R.S., On Sunspots and Rainfall.
R. Anderson, On Lightning Conductors.
Prof. Henry Hennessy, F.R.S., On the Climate of the British Islands.

There were a considerable number of meteorologists and meteorological observers present, the following being among the names :—

Ashe, I., M.D.	Dundrum.	Lloyd, Rev. H.D.D., F.R.S.	Dublin.
Barrington, R. M.	Fassaroe.	M'Cullough, D.M., M.D.	Abergavenny.
Brooke, C., F.R.S.	London.	Manning, R., C.E.	Dublin.
Browne, R. Clayton, D.L.	Carlow.	Moffat, T., M.D.	Hawarden.
Cosgrave, H. A.	Dublin.	Moore, Dr.	Glasnevin.
Copeland, R., F.R.D. ...	Dunecht, Aberdeen	Muirhead, Dr. H.	Cambuslang.
Eason, C.	Rathgar.	Perry, Rev. S. J., F.R.S.	Stonyhurst.
Elliot, Sir Walter, F.R.S.	Wolfelee.	Parsons, The Hon. R.C.	London.
Elliot, R.	Hawick.	Pengelly, W., F.R.S.	Torquay.
Enniskillen, The Earl		Rawson, Sir R. W.	West Drayton.
of, F.R.S.	Florence Court	Rosse, The Earl of, F.R.S.	Parsonstown.
Erck, W. S.	Bray.	Scott, Prof. A. W.	Lampeter.
Everett, Prof. J. D. ...	Belfast.	Smith, Prof. H.J., F.R.S.	Oxford.
Evans, J., F.R.S.	Nash Mills.	Smyth, J. jun., C.E. ...	Banbridge.
Gilchrist, J. M.D.	Dumfries.	Stokes, Rev. T. G.	Auchnacloy, Tyrone
Glaisher, J., F.R.S.	Blackheath.	Symons, G. J., F.R.S.	London.
Houghton, Rev. Prof. S.		Talmage, C. G.	Leyton.
F.R.S.	Dublin.	Verney, E.H., Capt. R.N.	Rhianva, Bangor.
Hennessy, Prof., F.R.S.	Blackrock.	Waller, G. A.	Dublin.
Herschel, Prof. A. S. ...	Newcastle-on-Tyne	Wilson, Major C. W.,	
Hudson, H., M.D.	Glenville.	C.B., R.E., F.R.S.	Dublin.
Jackson, M.	Ramsgate.	Wilson, W. E.	Streets, Rathowen.
Kinahan, E.	Dublin.	Yonge, Rev. D.	Newton Ferrers.

No meteorological breakfast was held, for two reasons—(1) because the Monday morning upon which it has hitherto taken place was

already occupied by the breakfast at the Zoological Gardens ; and (2) because there were so few meteorological papers as to be insufficient to occupy the meteorological Monday.

REPORT OF THE COMMITTEE ON LUMINOUS METEORS.

Mr. James Glaisher, F.R.S., read this report, which consisted of (1) an account of meteors doubly observed, with a table showing their real paths, velocities, and radiant points ; (2) a detailed account of large meteors ; (3) general directions and instructions to observers for recording meteors and aërolites, by Prof. A. S. Herschel ; (4) the discussion of a meteor of short period (viz., the fireball of November 27, 1877, for which a short period, such as, say, 500 days, is found), by Capt. G. L. Tupman ; (5) an elaborate analysis of the constituents of masses of meteoric iron and stone-falls, by Dr. W. Flight.

REPORT OF THE COMMITTEE ON UNDERGROUND TEMPERATURE.

Prof. J. D. Everett read this report. The principal novelty was the proposal to make observations in filled-up bores by a thermo-electric method. Two wires, one of iron and the other of copper, each covered with gutta-percha, were to be joined at both ends, where a portion would be left uncovered. One junction would be buried in the bore, while the other would remain above ground available for observation. A current would flow through the circuit composed of these two wires whenever the two junctions were at unequal temperatures, and the observer would immerse the accessible junction in a basin of water containing a thermometer, and would regulate the temperature of the water until he found by a galvanometer that no current passed. He would then know that the temperature of the water as indicated by the thermometer was the same as that of the buried junction.

THE RAINFALL OF IRELAND.

Mr. G. J. Symons, F.R.S., read a paper on "The Rainfall of Ireland," in which he mentioned that the Irish hills do not appear to exhaust the rain-clouds, as the English hills do. With the exception of a dry central area round Dublin the rainfall all over Ireland may be taken to be almost the same. At present, instead of the greatest rainfall being in the south-west, or in Galway, we had the wettest spot of all (with one exception) under the shadow of Slieve Donard, in the south of the county Down, the very place which, theoretically, might be expected to be almost the driest part of Ireland. That showed that it is really more a question of the elevation of hills than of geographical position. He exhibited a map showing the number of stations established for the observation of the rainfall, and the averages at many stations. From 1866 to '76 there were thirty stations established, at which the rainfall was regularly recorded, and at those stations the fall in the ten years was not very different from that in the five years 1872-76. It was, therefore, a fair conclusion that the average from '72 to '76 was not far wrong. It might probably be wrong three or four per cent.

He had succeeded since the meeting of the Association in Belfast in obtaining the services of a large number of gentlemen volunteers throughout Ireland, who had taken charge of the rain gauges supplied to them, and had engaged to register their observations. There were still large districts, however, in which he had not been able to establish rain gauges, and the observations were, therefore, necessarily defective as to the average rainfall. There was a large district in the neighbourhood of Longford without a single station, and another in the S.W. of Cork, where it was essential that observations should be taken. If he could induce some gentlemen having property in those neighbourhoods to take charge of rain gauges, Ireland, instead of having to depend upon ten stations, as it did not many years ago, would be fairly represented, both geographically and physically.

The President said that the thanks not only of the section, but of the whole

people of Ireland, were due to Mr. Symons for bringing this question of the rainfall more nearly home to them (hear, hear).

Mr. Lynam suggested that if some of the head-constables of police of the various districts and the canal lock-keepers, who were men of great activity and intelligence, were asked, they would be very glad to keep rain gauges, and would keep them with care and accuracy.

Professor Hennessy intimated that he had long ago come to the conclusion that the distribution of rain over Ireland would be partly governed by the coast line, and partly by the elevation of the ground. He spoke warmly of the labours of Mr. Symons, and hoped he would be backed up in any grant he might require to complete the observations.

Dr. Roche (Kingstown) said that rainfalls depended on the velocity of wind, and many other agents were to be considered besides height. Longitude had also a great deal to do with the weather. Rainfall was of great interest to agriculturists, and in a great measure depended on the quantity of trees in the country. Rainfall was found to be of very great importance to the agriculturist, who was, in fact, as much interested in the subject as the municipal engineer who ministered to the wants of large towns, but he suggested that in future maps, the extent of forestry in a district should be taken into consideration.

Mr. Price asked what was the actual average of the rainfall in Ireland as compared with that of England and Scotland. In a former publication of Mr. Symons the average at that time was given as in England, 29·84 inches; Scotland, 35·98; Ireland, 33·99; average of the United Kingdom, 33·27.

Mr. Symons said it was exceedingly difficult to give the average since they did not know what was occurring in large districts (hear, hear); but he was inclined to think that Ireland did occupy an intermediate position between England and Scotland. Ireland had the reputation of being a wet country, and no doubt, as regards drizzling, uncomfortable rain, that was perfectly true, but as for downpours of six inches a day, there were no traces of anything of the kind, except at two very remote stations. He mentioned that an attempt to get rain gauges kept by the constabulary had failed, but he did not see why the resident gentry and clergy of Ireland should not take charge of them as well as the corresponding classes did in England.

The President, in closing the discussion, expressed a hope that the gentlemen of Ireland would fall in with the suggestion.

ON THE CLIMATE OF THE BRITISH ISLANDS.

Professor H. Hennessy read a paper on this subject. He said that for years he had paid considerable attention to the study of the climate of these islands, and especially to the distribution of temperature over them. When he first made his investigations he was led to the conclusion that the distribution would be represented by isothermal lines having a certain parallelism to the coast lines of these islands. Since he first made his maps a vast number of observations had been collected by the Meteorological Society of Scotland. His own isothermal lines had been laid down from actual observation, because he had found out that the law of increase and decrease of temperature, in going in-land over a table land or flat country, was so extremely slow that it was perfectly absurd to use the co-efficient of one degree to 300 feet, which had been obtained by balloons. The actual results confirmed in the minutest particulars the theory of isothermal lines, which he propounded years ago, and he believed that the more observations were multiplied not only in these islands, but in New Zealand, Tasmania, and similar places, the more would it be found that his theory was correct. The islands, however, must have their coasts bathed by oceanic currents of a high temperature. The isothermal lines for Ireland showed that the distribution of temperature was more influenced by the sea than by latitude.

Dr. Rambaut said the laws of temperature ascertained by balloon ascensions must be quite different from those on a mountain side. The latter was the only true test.

Professor Hennessy said the law of decrease of temperature might be regarded as consisting of three divisions—rapid going up in a balloon; slow going up a mountain; still slower going along a plain, like a table-land. The average height of the table-land of Ireland above the level of the sea was 300 feet. The distribution of temperature was scarcely at all affected by that slight ascent. It was, therefore, absurd to take as a basis the result of one degree in 300 feet, which had been found in balloon ascents.

The Rev. S. J. Perry said of course there must be a great difference between the decrease in temperature observed during the ascent of a mountain and the ascent in a balloon. The temperature must be affected by the earth's surface, but in certain cases it was quite necessary to take the element of height into account.

THE PARIS METEOROLOGICAL CONGRESS.

The French meteorologists did everything which it was in their power to do to ensure the success of the above meeting, both as regards the arrangement of the programme and as regards offering splendid hospitality to their guests. General regret was expressed that only one Englishman was present, and in that regret we heartily share, because, as was pointed out at one of the banquets, there is hardly any branch of science in which International co-operation is so nearly indispensable as in meteorology. And although it was in these very pages asked if there had not already been enough congresses, yet it was acknowledged that their great advantage was in the personal acquaintance of the leaders of the meteorological world—and some of the very best men were there. We do not pretend to give an accurate list of those present, but taking first the foreigners, there were—Billwiller (*Switzerland*), Buys Ballot (*Holland*), Collins (*United States*), Denza (*Italy*), Hoffmeyer (*Denmark*), Montigny (*Belgium*), Ragona (*Italy*), Symons (*England*), Tacchini (*Sicily*), and Zenger (*Austria*). The French colonies were represented by General Farre and Harold Tarry for *Algeria*, d'Abbadie for *Central Africa*, and Borius for *Senegal*. Almost every branch of French meteorology was represented by its acknowledged leader—e.g., among those present we noticed Prof. Mascart (Director of the New Meteorological Office), Lemoine (coadjutor with Belgrand in all his hydrological researches upon the *régime* of the Seine), Tissandier (the scientific aeronaut), Alluard (the founder and director of the observatory on the summit of the Puy-de-Dôme), General Nansouty (the hero of many a fight for life with the frost and snow at his observatory on the Pic du Midi). But we must stop, although we have by no means exhausted the list of eminent Frenchmen, far otherwise we have not mentioned Brault, Cousté, du Moncel, Fron, nor even Renou, nor the President, to whom the Société Météorologique owes much, and the foreigners owe more, the talented and ever genial Hervé-Mangon.

We do not intend at present to give any report of the papers and discussions, because we are glad to announce that the French Government has undertaken to print a full report of the entire proceedings, and that copies shall be supplied at the cost of paper, postages, and sundries, roughly estimated at about six francs. Something was said

as to the number of copies printed being limited, it may therefore be well for those who desire to receive a copy either to write direct to the Secretary Société Météorologique de France, 7, Rue des Grands-Augustins, Paris, or if they prefer it the Editor of this magazine would order it, provided the order and the amount (5s.) reaches him by September 21st.

WATERSPOUT OFF SOUTHAMPTON.

To the Editor of the Meteorological Magazine.

SIR,—I had the opportunity of observing on the morning of Wednesday, the 21st of August, one of those most striking phenomena connected with the ocean, a *water-spout*, or sea whirlwind. Being on Ryde Pier at seven minutes past 12 on the morning of that day, and looking northward I saw a long continuous dark-slate coloured band of stratoid cloud resting on the opposite shore distant about four miles, and on the upper edge of this bank, exactly in line with Southsea Castle, I first observed a depression of a triangular form or cone of so peculiar an appearance that it attracted my attention. It seemed to travel independently of the cloud-bank, from E.S.E. to W.N.W. by W. Turning a powerful pair of Casella's field glasses upon the object I perceived a considerable disturbance of the sea, immediately under it and travelling with it. I then observed a long, and very thin, continuous column of water uniting the cone above and the whirl of water below; and I could see that the whole was in a state of rapid gyration, apparently revolving in a contrary direction to the hands of a watch of which the face is uppermost. The weather at this time was fine, but unsettled, heavy detached banks of clouds in all directions. Barometer, corrected and reduced, 30·054 in., falling; dry bulb 63°·2, wet bulb 57°·5; wind E., force 3.

It was difficult to guess at the height of the water-spout, as all surrounding objects were obscured by cloud and mist, but from measurements made on the spot with a sextant by a naval officer, it was judged to be about one mile in height, with a disturbed surface of whirling sea of about 100 yards diameter, distant $2\frac{1}{4}$ miles. The column of water was of a light color at its axis, but darker at its edges, giving it a hollow appearance. The sea below was in a state of intense disturbance, the rapid rotation of the water not only contributing to the formation of the column, but throwing out also large circular sheets of spray, which were not taken up with the main body of water. I carefully watched it pursuing its course along the opposite coast through Stokes Bay until it reached a promontory called Hill Head, at the entrance of Southampton Water, distant about seven miles. The phenomenon had a very striking appearance as it proudly and grandly swept past, the vehemence of the feeding whirlpool, and the graceful curve of the whirling column of water and the inverted cone spread into the clouds above, afforded a remarkable sight.

The column did not break off suddenly with a violent disrapture, as

I had expected, but became gradually absorbed into the heavy adjacent cloud-bank, and disappeared from view at 12h. 18m. I enclose a sketch taken when the water-spout was exactly ahead of Ryde Pier.

Yours very truly,

CHAS. H. GRIFFITH.

Strathfield Turgiss, Sept. 4th, 1878.

[We engrave the sketch as a frontispiece to this number, and add another description].

A WATERSPOUT IN THE RIVER.—The somewhat heavy rain which we experienced on Wednesday seemed to have resulted from the breaking at the mouth of the Southampton Water of the waterspout, reported by our Ryde correspondent as having been seen off that place. Mr. W. J. Jeaffreson writing to the *Times* from that place, gives a circumstantial description of the phenomenon. "Shortly before midday," he says, "the south-east wind had massed heavy black clouds, fringed with greyish cumuli, over the Hants coast. Just about 12, I observed a thin streak of grey descend from the cumuli, somewhat to the east of Southsea Common, and stand out strongly against the black masses beneath, as it passed rapidly to the westward. It was not till a few minutes after 12 that I observed this thin streak to be in communication with the water, which threw up a column of white spray and foam distinctly visible, though quite four miles distant, at a height of several feet above the surface. A glass showed the disturbance to be considerable, though no pillar of dark water rose above the waves and the area of the gyration was not extensive. The waterspout moved rapidly, at an apparently short distance from the Hants shore, past Southsea pier and the entrance to Portsmouth Harbour. As it crossed Stokes Bay the commotion appeared to increase until it passed the White-house beyond the railway pier. Mr. Wynan's "Cigar ship" was not far from it at this point, and those on board must have had an excellent view. On nearing the opening of Southampton Water, and before nearing the Lightship at the Spit, the phenomenon disappeared in a heavy downpour of rain. One small yacht seemed close to the vortex just before its disappearance. Though less violent and affecting a smaller area and mass of water than a tropical waterspout, this one struck me as being very remarkable from its enormous height."

WATERSPOUT.—This extraordinary phenomenon near Stokes Bay on Wednesday morning, was witnessed by a large number of persons on Ryde pier. It is notable that there was a considerable rise in the temperature just before the waterspout was seen.

EXTRAORDINARY HAILSTORM.

To the Editor of the Meteorological Magazine.

SIR,—I must give a short description of the fearful hailstorm by which we were thoroughly smashed on the evening of August 4th. I had intended to send an account of several heavy thunderstorms which have occurred here since I last wrote, but these all are insignificant compared with that of the 4th. That oft-quoted authority, the "oldest inhabitant," is probably right on this occasion in asserting that he never saw anything like it. For my own part, I never witnessed a hailstorm approaching this in severity, even including the destructive hailstorms which occurred in the neighbourhood of Hereford on August 13th, 1857, or another which I can remember in 1848.

On August 3rd, a fog which had occurred in the early morning cleared about 8 a.m. Wind N.N.E., moderate; upper current, which carried fragmentary electrical clouds, E. by S. Thunder commenced in S.E. at 10.15, and continued with but little intermission between the claps (at times it was an unbroken roll) for two hours. This storm did not reach us, but worked its way very slowly to W.S.W. of this station, the nimbus becoming more circumscribed as it travelled. At 7 p.m. a dense bank of cirro-stratus extended over the N.E. sky, the edge moving rapidly from S.E. This bank spread slowly over us, and at 10 p.m. rain commenced, with a brisk N.E. wind.

The rain continued throughout the night, and from 3.45 to 7.45 of the 4th we had much thunder and lightning, which appeared heaviest in the E. On emptying the gauge at 9 a.m. I found that 0.83 in. had fallen. At 8 a.m. wind was N.E. and light, with a rapid E. upper current; the sky clearing in S.E. Nine hours of generally bright sunshine succeeded, during which the breeze went round to S.S.E., while the cirrus-current backed towards N.E. Cumuli of very high, narrow and fantastic forms hung about the sky; and at 3.20 p.m. a local thunderstorm broke in distant S.S.W., and travelled slowly off to W. At 4.30 a yellowish appearance began to be noticeable all over the southern sky, and in a short time a bright orange-coloured bank of cirrus appeared over that horizon, running up in filmy threads towards the zenith, the edge moving rapidly from E.S.E. Beneath the bank were vast towers of inosculating cumuli. Thunder commenced at 5 p.m. in S.S.E., and from that hour to 5.45 the storm rapidly approached, apparently increasing greatly in intensity, lightning being exceptionally vivid. When about two miles distant the peculiar roar of hail could be heard between the crashes of thunder, and was so very loud that it was evident that the storm would be of unusual violence. Observers had just time to get into their houses and shut windows and doors when it was upon us in its fury. This was at 5.50. What followed can best be described by its effects.

In a quarter of an hour hail covered the ground to the depth of two inches. All houses were thoroughly flooded, and windows facing S.E. generally smashed. Out of doors, flowers and vegetables had disappeared *in toto*, and as for the gardens,—“*fuit Ilium.*” The change of scene, from a brilliant August afternoon to a partial January thaw, was most theatrical. Fields all white, except here and there where black pools lay amid the ice; men engaged in shovelling the ice out of the village street, and digging it away from the doors of the houses; wreaths of white fog creeping over the surface, and overhead that leaden sky which is usually noticeable over snow-covered ground. The storm had gone, and left a wintry wilderness behind it.

Having to attend to the condition of my deluged house, and having a service in the church at 6.30, I was unable to weigh or take measurements of the hailstones until 8 p.m., when I found the stones to be in all cases exceptionally round and hard (presenting in this respect a marked contrast to those which fell in August, 1857), so hard that

there were several which I failed to break with my teeth. I measured some, which were just $4\frac{1}{2}$ inches and one which was $5\frac{1}{4}$ inches in circumference. This was two hours after they fell. Drifts of ice several feet in depth had been formed by the rushing water. Many of these drifts lay through the next day, in hot sunshine; and even yesterday evening, 78 hours after the storm, in warm weather, and when another inch of rain had fallen in the thunderstorms of the 6th, ice could still be gathered in some of the ditches.

The hailstones in this storm leapt several yards from the ground as they fell on my lawn, and the rain-gauge was also so much blocked by the ice that I do not trust its record at all. It yielded 1.34 in., falling in about 22 minutes, but I consider this very short of the actual fall.

The storm, which had come to us from S.S.E., turned somewhat to W. shortly after passing this place, and seemed to become much less severe. At 8.30 p.m. it presented itself in the W. as a bank of cirrus moving from a N. or N.E. point. At that hour a small thunderstorm was visible in the E., the lightning being bright, but thunder only faintly audible.

I find that at Lutterworth, 3 miles S.E. of this place, the hail was comparatively light, though some windows were broken. Two miles to the W. very little hail fell; and it did not extend far to the N., certainly did not reach Leicester. A few miles to the E. and N.E. the storm was very slight. The area of the great hail was, therefore, very circumscribed, and this place seems to have been exactly in the focus of the storm.—I am, Sir, yours truly,

W. CLEMENT LEY.

Ashby Parva, Lutterworth, August 8th, 1878.

TREES AND FROST.

To the Editor of the Meteorological Magazine.

SIR,—A friend of mine writing from Switzerland asks me to find out from ascertained data, what degree of cold (Fahrenheit), the sap of any given tree, and of the English pine in particular, can support, without injury to the tree, and what degree of cold would kill that tree. He tells me that some experiments have been made by priests of the convents on the Italian mountains, and that the results, as reported, are surprising. He doubts whether the circumstances under which the experiments were tried were such as scientific accuracy would require. If any of your readers can give me information on the subject that cannot be called in question, I shall be much obliged.

Faithfully yours,

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

Bannerdown House, Batheaston, 23rd August, 1878.

[Probably Col. Ward is aware of the paper by Mr. Forbes, of Culloden, reviewed in Vol. II. of this Magazine, page 94; it does not give *precisely* the data required, but is a very valuable pamphlet.—ED.]

THE EXCEPTIONAL RAINFALL OF 1878.

It is too early, and there is not in these pages room, to treat fully of the remarkable features of the rainfall of this year. By the insertion of two or three letters in previous numbers, we have given some details of the heavy individual rains in North London. We append to this a few letters respecting the fall on the south coast of England in August.

But that it is not alone the south coast, which has received an exceptional rainfall, is shown by the general tables, and by the observers remarks on page 126, to which we desire to call attention. This being the case, we further illustrate the matter by the following table:—

Daily Rainfall in August, 1878.

	London.	Margate, Acol.	Brighton.	Hastings.	St. Lawrence.	Solborne.	Stratfield Turgiss.	Hitchin.	Banbury.	Swaffham.	Cheadle.	Killingholn.
1...	...	10	...	...	...	...	...	01	...	...	...	...
2...	04	24	17	18	16	04	...	02	02	01	25	22
3...	1 41	...	10	87	77	45	10	40	29	60	09	29
4...	60	...	12	01	14	17	22	1 13	73	...	62	30
5...	52	13	40	46	35	36	40	74	12	21	16	23
6...	...	...	01	...	...	...	...	...	09	...	1 21	93
7...	...	...	...	09	...	...	...	...	...	...	19	36
8...	...	02	...	...	...	...	...	...	...	...	...	...
9...	13	...	...	10	04	...	...	01	04	...	41	08
10...	18	18	11	02	1 15	10	12	20	20	19	64	20
11...	06	...	15	06	16	11	...	06	09	06	41	13
12...	13	03	12	03	05	20	14	01	...	25	09	08
13...	31	14	42	45	42	64	36	45	62	60	85	64
14...	01	...	01	01	...	...	...	07	04	36	26	14
15...	21	96	40	52	56	45	13	12	03	...	43	01
16...	25	36	12	12	08	12	18	65	17	34	21	13
17...	...	...	...	...	...	...	42	...	...	...	01	01
18...	...	...	02	06	03	...	...	...	...	...	...	...
19...	...	...	...	01	...	...	...	...	...	...	...	...
20...	...	...	...	...	15	...	...	...	...	...	...	...
21...	...	...	...	...	...	...	...	...	...	...	...	...
22...	46	15	32	20	30	32	60	34	67	16	44	03
23...	38	...	05	1 77	...	22	50	15	39	20	12	40
24...	53	...	75	1 56	01	14	09	21	01	14	37	12
25...	31	34	07	01	...	06	02	07	...	09	06	1 14
26...	01	10	06	22	14	12	...	...	...	...	05	05
27...	17	...	07	10	10	10	04	09	01	13	27	58
28...	13	...	51	38	04	06	22	07	02	...	04	...
29...	15	05	26	11	08	67	51	79	35	93	08	12
30...	41	03	10	1 55	91	42	16	13	12	36	10	53
31...	32	63	18	13	08	06	03	07	06	25	55	25
	6 72	3 46	4 52	9 02	5 72	4 81	4 24	5 79	4 07	4 88	7 91	6 97

In confirmation of the remarks of several observers as to the rarity of the phenomena of this summer, and indeed of the whole year up

to date, we add a few notes on the rainfall at Camden Square. It is, in fact, altogether without precedent. Attention was called to the exceptionally heavy daily falls, in our last number, but besides this, not only have many of the monthly totals been above their individual averages, but some of them are higher than any other monthly falls at Camden Square since observations were commenced in 1857, as shown by the accompanying table, in which it will be seen that although the amount in June was nearly half-an-inch greater than in any previous month for twenty years, it has been actually exceeded in August, so that this year we have had the two heaviest monthly falls, and the two heaviest daily falls, yet recorded there.

Table, showing the Total fall at Camden Square in every month since December, 1857, in which the Rainfall has exceeded 5 inches.

	in.		in.
1860. June	5.47	1872. October.....	5.20
1865. October.....	6.22	1876. December	6.25
1868. December.....	5.12	1878. June	6.71
1871. August	5.28	„ August	6.72

On comparing the number of rainy days, we find that they are very slightly above the average, except in August, which is accounted for by the fact that the excess in the monthly totals was due more to heavy daily falls than to long wet periods.

The total rainfall from the 1st January to 31st August (26.85 in.) is more than ten inches above the average for that period, and nearly two inches above the average for the entire year, of which there are still four wet months left, and even if the rainfall in them be only equal to the average, the yearly total for 1878 will far exceed even that recorded for the extraordinarily wet year 1872.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall of last month exceeds the fall of the whole of the three months, April, May, and June. The total measurement of those months was 9.11 in., that of August was 9.39 in. On the 24th a great quantity of rain fell between 4.15 a.m. and 9 a.m. I measured 1.94 in. At 3.15 p.m., a severe thunderstorm passed over, with hail; the storm lasted till about 5.30 p.m., and I then measured 1.75 in., making a total of 3.69 in. There was no thunder with the first rain, and the wind N.E. and calm.—Yours faithfully,

CHARLES M. MURRAY.

The Firs, Ore, Hastings, Sept. 3, 1878.

To the Editor of the Meteorological Magazine.

SIR,—My total rainfall for last month (August) was 9.85 in. ! Of this, 4.55 in. fell on Saturday, the 24th; rain commenced after mid-

night: amount in gauge at 8.30 a.m., 2.00 in.; rain ceased at 10.30 a.m., 0.35 in.; rain, with thunder, at 12.30 till 1.15 p.m., 0.10 in.; thunderstorm commenced at 3.15 p.m., and ended 4.30 p.m., rain collected 2.10 in. Total rain between midnight and 4.30 p.m., 4.65 in. 2.05 in. fell on Saturday the 31st.—Yours truly,

JAS. ROCK.

Brookwood, Hollington, Hastings.

To the Editor of the Meteorological Magazine.

SIR,—The amount of rain for August is greater than for any month since July, 1874, when I first began observations.

On the 3rd, at 9 p.m., there was 0.65 in. in the gauge. This fall took place almost entirely between 7.30 and 7.55 p.m., when a severe thunderstorm was passing over us.

The 1.77 in., entered to the 23rd, fell during a few hours of the early morning of the 24th. On the same day a very severe thunderstorm occurred in the afternoon, when, besides other damage, a barn was struck by the lightning, set on fire, and burnt to the ground. During its continuance 1.565 in. of rain fell. Unfortunately, I was away from Hastings at the time, and my deputy made no extra observations. I have asked my friend, C. Murray, Esq., of Ore, which is only about two miles from here, to send you an account of the storm.

Part of the 1.55 in., of the 30th, fell during the night of that day, but the main portion in the early morning of the 31st, but there was no thunderstorm.—I am, Sir, faithfully yours,

ALEX. E. MURRAY.

*Manor House, Hastings,
2nd Sept., 1878.*

To the Editor of the Meteorological Magazine.

SIR,—Till I read the account in *the Times* of to-day of the rainfall near Hastings, I thought we had the largest amount to record at this place. During August I measured 7.96 inches on 19 days—at 9 a.m. on the 23rd, 2.29; at 9 a.m. on the 24th, 1.49; making a total of 3.76 in sixteen consecutive hours, from a little past 8 p.m. on Thursday night till noon on Friday. I have only one instance of larger fall in 24 hours, 3.84 in. on Aug. 13th, 1858, and one of 3.63 in 36 hours, July 14th and 15th, 1875.

Our recent heavy fall was not accompanied by any near thunderstorm, although there were heavy ones subsequently on the Cotswold Hills, and to the E. and S.E. of us.

There has been no August since 1771 with equal fall in these parts, except, perhaps, 1782, when Gilbert White, at Selborne, registered 8·28; 1775 and 1797 had, however, very wet Augusts.

Yours faithfully,

H. SOUTHALL.

*The Graig, Ashfield, Ross,
Sept. 5th, 1878.*

P.S.—I am glad to say, notwithstanding, that the harvest is nearly completed, and the corn is not much injured.

SUPPLEMENTARY TABLE OF RAINFALL IN AUG., 1878.

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

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	3·46	XI.	Castle Malgwyn	5·80
„	Littlehampton	3·37	„	Nantgwilt, Rhayader	8·91
„	Hailsham	4·42	„	Carno	7·50
„	St. Lawrence, I. of W....	5·72	„	Rhug, Corwen	4·65
„	Strathfield Turgiss	4·24	„	Port Madoc	5·10
III.	Addington Manor	4·97	XII.	Carsphairn	4·80
„	Oxford	5·57	„	Melrose	4·63
„	Northampton	4·41	XV.	Gruinart	4·15
„	Cambridge	3·74	XVI.	Grandtully .....	...
IV.	Sheering	4·10	XVII.	Tomintoul	4·69
„	Diss	3·77	„	Keith	6·07
„	Swaffham	4·88	XVIII.	Dalwhinnie .....	...
V.	Alderbury, Salisbury ...	3·66	„	Achnasheen	2·52
„	Compton Bassett	4·72	„	Springfield, Tain	4·10
„	Dartmoor	8·96	„	Glenfinnan	7·98
„	Langtree, Torrington ...	5·85	XIX.	Watten	1·36
„	Cosgarne, St. Austell ...	6·66	XX.	Glenville, Fermoy	7·83
„	Taunton .....	...	„	Tralee	4·82
VI.	Bristol	4·40	„	Tipperary	4·20
„	Sansaw	5·34	„	Newcastle W., Limerick ..	5·58
„	Cheadle	7·91	„	Kilrush	4·06
„	Bickenhill Vicarage	6·66	XXI.	Kilkenny	4·29
VII.	Coston, Melton Mowbray ..	5·48	„	Kilsallaghan	5·44
„	Bucknall	7·14	„	Twyford, Athlone	5·36
VIII.	Walton, Liverpool	4·03	„	Belvedere, Mullingar ...	5·15
„	Broughton-in-Furness ..	7·07	XXII.	Ballinasloe	6·66
IX.	Stanley, Wakefield	4·90	„	Kylemore .....	...
„	Mickley, Ripon	7·05	„	Carriack on Shannon	4·10
X.	Gainford	4·89	XXIII.	Rockcorry	3·82
„	Unthank Hall	6·57	„	Warrenpoint	3·16
„	Shap	3·99	„	Newtownards	2·39
XI.	Llanfrechfa	8·24	„	Bushmills	6·61
„	Solva	5·16	„	Buncrana	3·29

AUGUST, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which -01 or more fell.	TEMPERATURE.				No. of Nights below 32°		
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.		In shade	On grass.	
				Dpth	Date.		Deg.	Date.	Deg.	Date.			
		inches	inches.	in.									
I.	Camden Town	6·72	+ 4·08	1·41	3	22	79·4	5	50·1	17	0	0	
II.	Maidstone (Hunton Court)...	4·59	+ 2·39	·61	3	18	...	...	...	...	...	...
III.	Selborne (The Wakes).....	4·81	+ 1·63	·67	29	20	77·0	5	42·5	22	0	0	
III.	Hitchen	5·79	+ 3·44	1·13	4	22	72·0	7, 9	44·0	24	0	...	
IV.	Banbury	4·07	+ 1·94	·73	4	20	74·5	8	48·0	17	0	...	
IV.	Bury St. Edmunds (Culford)...	4·28	+ 1·84	·95	24	19	77·0	5, 6	41·0	20	0	0	
V.	Norwich (Sprowston).....	4·57	...	·59	27	22	...	...	...	...	...	...
V.	Bridport	3·55	+ ·96	·86	5	15	...	...	...	...	...	...
V.	Barnstaple	5·62	+ 1·43	1·27	23	19	77·0	1†	55·0	2	0	...	
V.	Bodmin	6·39	+ 2·53	·88	22	25	75·0	19	50·0	4	0	0	
VI.	Cirencester	4·87	+ 2·03	1·35	22	17	...	...	...	...	...	...
VII.	Shifnal (Haughton Hall) ...	5·12	+ 2·25	·74	5	20	75·0	9	46·0	1	0	0	
VII.	Tenbury (Orleton)	7·81	+ 4·93	1·98	3	22	75·0	8, 14	44·5	8	0	0	
VII.	Leicester (Town Museum) ...	6·76	...	1·78	3	22	74·8	5	46·1	1	0	0	
VII.	Boston	5·31	+ 3·02	·94	13	21	...	...	...	...	...	...
VII.	Grimsby (Killingholme)	6·97	...	1·14	25	24	71·5	18	47·0	21	0	...	
VIII.	Mansfield	8·27	...	1·30	23	24	72·8	9, 26	43·9	1	0	0	
VIII.	Manchester (Ardwick).....	5·64	+ 2·13	·94	13	22	76·0	2	48·0	3	0	0	
IX.	York	3·99	+ 1·28	1·27	13	15	...	...	...	...	...	...
X.	Skipton (Arnccliffe)	7·19	+ 1·25	·80	13	26	74·0	26	42·0	25	0	...	
X.	North Shields	4·71	+ 1·86	·94	3	19	69·3	7	46·0	17	0	...	
XI.	Borrowdale (Seathwaite).....	9·51	— 4·57	1·42	11	19	...	...	...	...	...	...
XI.	Cardiff (Crockherbtown).....	10·82	...	3·64	15	24	75·4	5	49·0	17	0	...	
XI.	Haverfordwest	7·67	+ 2·79	2·20	4	17	74·0	1	43·0	16	0	...	
XI.	Aberdovey	5·29	...	·82	13	19	93·0	25	52·0	17	0	0	
XII.	Llandudno	4·46	+ ·64	1·57	13	18	78·5	5	51·2	26	0	...	
XII.	Dumfries (Crichton Asylum)...	3·14	— ·51	·80	30	18	78·8	1	43·0	17	0	0	
XII.	Hawick (Silverbut Hall).....	4·16	...	1·19	29	18	...	...	...	...	...	...
XIV.	Glasgow (Cessnock Park) ...	2·89	— ·79	·84	15	17	...	...	40·0	8	0	...	
XVI.	Mull (Quinish)	3·14	...	·74	11	14	...	...	...	...	...	...
XVI.	Loch Leven	3·90	+ ·22	·80	17§	13	...	...	...	...	...	...
XVI.	Tyndrum (Ewick) .....	...	...	...	...	...	...	...	...	...	...	...
XVII.	Arbroath	4·78	+ 1·55	·98	6	19	72·0	18	51·0	17†	0	...	
XVII.	Braemar	7·85	+ 4·01	1·70	15	21	77·0	2	34·8	23	0	1	
XVIII.	Aberdeen	3·71	...	·88	15	25	73·1	1	46·4	18	0	0	
XVIII.	Gairloch	2·51	...	1·02	7	13	...	...	...	...	...	...
XVIII.	Portree	3·51	— 3·94	1·56	7	14	...	...	...	...	...	...
XVIII.	Inverness (Culloden)	4·42	+ 1·17	1·10	16	19	72·9	1	44·9	23	0	0	
XIX.	Dunrobin	3·06	+ ·60	·60	15	19	73·5	4	44·0	12	0	...	
XIX.	Sandwick	1·40	— 2·31	·28	10	13	69·5	1	41·4	20	0	0	
XX.	Caherciveen Darrynane Abbey	6·46	...	1·00	21	28	...	...	...	...	...	...
XX.	Cork	7·07	...	1·50	23	19	...	...	...	...	...	...
XX.	Waterford .....	...	...	...	...	...	...	...	...	...	...	...
XX.	Killaloe	4·75	— ·18	·71	13	20	83·0	1	46·0	28	0	...	
XXI.	Portlannington	3·60	— ·90	·60	13	24	75·0	1	47·0	27	0	...	
XXI.	Monkstown, Dublin	6·22	+ 3·01	1·75	13	22	...	...	...	...	...	...
XXII.	Galway	6·14	...	1·15	13	24	80·0	2	49·0	12	0	...	
XXIII.	Waringstown	3·52	...	·63	7	19	79·0	3	45·0	16	0	0	
XXIII.	Edenfel (Omagh)	3·57	...	·68	26	19	76·0	1	44·0	16§	0	...	
XXIII.	Ballyshannon	3·87	...	·50	7*	16	...	...	...	...	...	...

* And 13, 27.

† And 6, 7, 10.

‡ And 23.

§ And 18.

§ And 31.

+ 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.—Much T on the 3rd; a man at work near my house fell down, either struck by L or from fright. I never witnessed such vivid L or heard so loud a clap of T before. The harvest much retarded by the wet weather during the last half of the month, and the wheat somewhat injured.

BANBURY.—Thunderstorms on 3rd, 4th, 10th, 23rd, and 30th.

CULFORD.—Easterly winds prevailed during 15 days; TSS were frequent, and that of the 30th was remarkably severe. The rainfall (upwards of $4\frac{1}{2}$ in.) was much above the average. Average temp., $60^{\circ}5$.

SPROWSTON.—An excessively wet month, with a great deal of T. Harvest operations much delayed, and corn secured in very bad order.

BODMIN.—Average temp., $64^{\circ}6$. Rainfall, 2.19 in. above the average of 29 years.

SHIFNAL.—R almost daily till the 17th, and from the 26th to the end. Harvest, which commenced early in the month, sadly impeded and much damage done, especially to the cut barley. The wettest August since 1860, when 5.58 in. fell. Wasps increased rapidly by the 7th, and were most destructive even to the half-ripe fruit. Swifts gone by 10th. Few butterflies seen, and not one clouded-yellow after the strange influx of that rare sort last August.

ORLETON.—The temp. of the month was even, and about half-a-degree below the average. Rainfall excessive. The only months during the last 48 years in which the rainfall amounted to 7 in. were—July, 1834, 9.23 in.; September, 1852, 7.07 in.; November, 1852, 8.22 in.; June, 1860, 7.25 in.; September, 1871, 7.25 in.; so that the fall of this month 7.81 in. has only been exceeded twice in the last 48 years. On the afternoon of the 3rd, during a great TS, 1.91 in. of R and H fell in four hours; a few miles E. and S.E. the fall was greater. Again on the 22nd and 23rd, 2 in. fell in 24 hours, and in consequence the river Teme was level full. The weather was generally very showery, and distant T was frequently heard; but there were a few bright days. The bar. was generally low and steady and the movement of the air light, except on the 17th and 28th, when the wind was rough.

LEICESTER.—Thunderstorms frequent.

KILLINGHOLME.—A disastrous month, the wettest during the last 12 years. Very little corn carried, though most of it has been cut. Potatoes more free from disease than could have been expected. TSS on 11 days. Wheat harvest general by the 8th.

MANSFIELD.—Thunderstorms on the 4th, 6th, 24th, and 30th; those of the 6th and 30th being severe.

ARDWICK.—A month of unsettled weather, unusually wet and sometimes cold. Two or three TSS, but not very severe.

NORTH SHIELDS.—Thunderstorms on four days.

SEATHWAITE.—Rainfall below the average; only two days on which the fall exceeded 1.00 in.

WALES.

HAVERFORDWEST.—A very warm, fine month; T and L very frequent, and in some places severe storms. Three heavy rainfalls took place, two exceeding 1.00 in. and one exceeding 2.00 in. All green crops looking remarkably well; abundance of grass: few remember so much at this time of year. Although the weather has been trying owing to so much R, the harvest operations have not been seriously interfered with or the crops much injured. Ther. at or above 70° on 13 days, few nights below 55° .

ABERDOVEY.—The month was on the whole favourable for harvest operations. Heavy R occasionally from 9th to 16th. T on 29th.

LLANDUDNO.—A wet but warm month. Mean temp. $1^{\circ}5$ above the average. The temp. was tolerably equable, but the winds were variable both in strength and direction. A heavy gale on the night of the 3rd, and a heavy rainfall on that of the 13th, when 1.57 in. fell.

SCOTLAND.

HAWICK.—A very good harvest month, and much corn secured in fine order. The turnips are looking beautiful, and potatoes keeping clear of disease. The heavy rains of the last three days freshened up the pastures, which were much parched.

CESSNOCK PARK.—Distant T on 7th, 25th, and 28th.

QUINISH.—Showery broken weather from 6th to 12th. Hot and moist from 25th to 30th. Rest of month very fine and warm.

ARBROATH.—Rainfall two inches above the average of the last 36 years. TS on 7th.

BRAEMAR.—A very wet month. L on 12th and 13th.

ABERDEEN.—A rather dull month, with temp. a little above the average. Mean temp. $57^{\circ}3$. Rainfall 0.55 in. above average of 21 years. T and L on 8th.

DUNROBIN.—The month was, on the whole, favourable for all kinds of crops.

SANDWICK.—A pleasant month. The R was not half the average of the previous 37 years. Since the 24th the weather has been hazy, with very few gleams of sunshine. All kinds of crops are above the average, and reaping has begun.

IRELAND.

DARRYNANE ABBEY.—The wettest August for the last nine years. As a consequence, the hay and corn harvests are very backward; indeed, as a rule, the oat crop is destroyed. Potatoe crop also very bad.

KILLALOE.—T and L frequent, particularly on 27th. R heavy, and delayed harvesting.

WARINGSTOWN.—A very fine month on the whole, though the first fortnight was showery. All crops unusually good.

EDENFEL.—Although the rainfall was large, the weather was, on the whole, very favourable, and by the end of the month the most abundant harvest for many years was in full operation.

BALLYSHANNON.—The month was warm and favourable for harvest work. The crops are all good, and this year promises to be a cheap and plentiful one for the different agricultural products.

THE WEATHER IN AUGUST.

For the first three days in August there was a nearly general fall of the barometer. On the 2nd the readings were highest in the north and lowest in the south. A depression moving northward across France on the 2nd, had its centre on the 4th over the south of England, the Netherlands, and the north-east of France. The next day it was moving in a westerly direction to the south of Ireland, where it disappeared. After this mercury began to rise, and on the 9th was uniformly high over Germany, France, and England, but was beginning to fall somewhat decidedly in the west of Ireland and over the Bay of Biscay; this fall became more brisk on the 10th, 11th, and 12th, when numerous depressions appeared in the west, moving east-north-eastward. On the 10th a primary depression advanced north-eastwards from the Atlantic

towards Scotland, and a small secondary one was travelling in a similar direction across England, followed by a temporary rise of the barometer. During the first ten days of the month, the weather was mild, but dull, very showery, and marked by frequent and severe thunderstorms in most parts of the United Kingdom. The wind was for the most part very changeable; breezes from opposite points of the compass succeeded each other very quickly.

During the next period (12th to 17th) the weather was exceptionally wet and unsettled. The barometer was continuously highest over France and the Bay of Biscay, and several depressions passed over us, bringing with them, not only heavy falls of rain, but in some cases (*e.g.*, between the 12th and 14th) very strong winds and gales from south-west and west. Thunderstorms were frequent and severe; temperature was rather low and the barometer very unsteady. On the 15th the barometer was high both in the south and north, low in the west, and falling. New depressions advanced towards Ireland during the night, the old ones disappearing over the Baltic and Russia. The following day a well-defined pear-shaped depression crossed over England in an east-north-easterly direction, the barometer rising generally in its rear. On the 17th this depression was over Denmark and the south of Norway. A very small shallow disturbance passed near our extreme west and north-west coasts in the day time, but soon dispersing or travelling away northwards.

From the 17th to 22nd no important change occurred. The weather was fine in some places in these islands, but was dull and cloudy over most parts of the Continent.

On the 22nd the centre of a well-formed and rather deep depression arrived off the south of Ireland from the S.W., making gradients rather steep for south-easterly winds in the S.W. In the N.E. the barometer still rose, and an area of high pressure lay over the North Sea, and a smaller one over the south of France. On the following day the depression had advanced to the mouth of the English Channel, where it dispersed; and a secondary depression travelled across France, lay near the Isle of Wight. On the 24th this depression became much larger (but no deeper), spreading over all these islands and apparently had two or three centres. Pressure was very irregularly distributed to the westward of these islands, while a higher barometer (30.1 in.) was reported from the northern parts of Scandinavia, and rather lower readings from the south of France. The weather was consequently very unsettled; a heavy fall of rain (0.6 to 0.8 in.) occurred in France; at Valentia 0.60 in. fell, and smaller amounts in London and elsewhere.

On the 27th the barometer rose somewhat decidedly in the south, whilst it fell over Scandinavia, and the region in which so many irregularities in pressure were noticed, lay considerably to the northward of the position it had recently occupied. A fresh fall of the barometer was in progress at Valentia, but this lasted a very short time, the mercury again rising more than a quarter of an inch during the day. On the 28th a further rise was reported from all parts of our islands and France, and a further fall in Sweden, while in the north pressure continued to be very irregularly distributed. The weather became fine generally over these islands, though no considerable increase of temperature took place.

On the 29th a small well-formed depression reached the mouth of the St. George's Channel from the Atlantic; and travelled suddenly to the east-north-eastward till it lay over Cambridgeshire on the 30th, while another depression crossed the north of these islands and lay off the Northumberland coast. By the 29th the weather had again become very unsettled over the United Kingdom, and thunderstorms prevailed in our southern counties. Large quantities of rain fell over our islands and Holland, the largest amounts being 1.4 in. at Scilly, 1.1 in. at the Helder, and 0.9 in. at Greencastle, Oxford, and Cambridge.

H. E. M.

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THE BRITISH ASSOCIATION AT DUBLIN.

(Continued from page 116.)

WE now give notices of all the meteorological papers not reported in our last number. And we may preface them with two remarks—one a regret that we accidentally omitted from the list of observers present at the meeting one of the most able, viz., Mr. W. H. Wheeler, C.E., of Boston. As Mr. Wheeler contributed a valuable paper to the discussion on “River Administration,” it is rather strange that we should have overlooked it. The other remark is that we hope that we shall not be held responsible for the report of the paper on “Rainbows.” We did not hear it read, and we accurately reprint the only report of it which we have seen.

ON LIGHTNING CONDUCTORS AND ACCIDENTS BY LIGHTNING, By RICHARD ANDERSON, F.C.S., M.S.T.E.

ONE hundred and twenty-six years have elapsed since Benjamin Franklin discovered, by means of his famous kite, that lightning could be drawn from the clouds, and its destructive qualities extinguished, by very simple means; and one hundred and ten years are gone by since the first of Franklin's “lightning rods” was set up for protection over the dome of England's metropolitan cathedral, St. Paul's. Yet so slow has been the “march of progress” in the application of one of the greatest scientific discoveries of modern times to the uses of daily life, that even now, after the lapse of more than a century, the employment of lightning conductors, simple as they are, and as inexpensive as simple, is far from being general, still less universal. At least one-half, and perhaps two-thirds, of all the public buildings, including the churches and chapels, of Great Britain and Ireland, are without protection against lightning. As to private houses, it is safe to assert that not five out of every hundred have lightning conductors. It is well known that the amount of property destroyed annually by lightning is very great, though it is naturally impossible to form any estimate of it. However, there are some facts as to the annual destruction of human life. According to the “Thirty-ninth Report of the Registrar-General,” issued in July, 1878, and former reports, the number of deaths from lightning in England and Wales was as follows in each of the

eight years from 1869 to 1876, as given in the first portion of the following table :—

ENGLAND AND WALES.				PRUSSIA.		
Years.	Males.	Females.	Total.	Males.	Females.	Total.
1869	5	2	7	47	32	79
1870	13	6	19	59	43	102
1871	23	5	28	56	47	103
1872	35	11	46	50	35	85
1873	17	4	21	61	50	111
1874	25	—	25	52	41	93
1875	14	3	17	92	48	140
1876	15	4	19	59	47	106
Total	147	35	182	476	343	819

The returns from deaths by lightning given by the English Registrar General are admittedly incomplete. In Prussia, where the registration of the causes of death is under the enforcement of strict legal enactments, and, in consequence, far more accurate than in England, there were 819 persons reported as killed by lightning in the eight years from 1869 to 1876. According to the report of Dr. Engel, Director of the Statistical Bureau of Berlin, the number of lives lost was as given in the second portion of the above table.

The population of Prussia is larger than that of England and Wales—25 $\frac{3}{4}$ millions against 24 $\frac{1}{2}$ millions—but, on the other hand, thunderstorms are less frequent there than with us. Altogether, it will be rather under than over the mark to say that as many persons are killed by lightning in England as in Prussia, the loss of life amounting to over a hundred every year on the average.

The terrible losses, both of property and human lives, still occasioned by lightning, are the more lamentable as they are in nearly all cases the result of the grossest negligence. The negligence is threefold—namely, first, in not providing any lightning conductors at all; secondly, in not placing them in the right position, or in sufficient number to cover a given area; and, thirdly, in not having them regularly tested, so as to ascertain their constant efficiency. Of course, the first-mentioned cause of neglect is by far the most important. It is one alike astounding and baffling all search for a reasonable explanation. Every year brings its regular thunderstorms, more or less in number, and most of them accompanied by fatalities.* All see the terrible lightning flashing over their heads; all tremble before the approach of the awe-inspiring electric force, the mere touch of which brings instantaneous death, and yet but an excessively small number of persons make any efforts to protect themselves, their families and houses, against the electric fire from the clouds. Public buildings fare little better than private houses. Even some of the first cathedrals of England, such as Peterborough, have no lightning conductors whatever, while others, supplied with them, are insufficiently protected, as apparent to any competent observer. A glaring case of absence of protection against lightning is to be found at Windsor Castle, grandest of all the historic buildings of England, and residence of her sovereign. It may seem incredible, but

* Mr. G. J. Symons mentions that in two storms, in June, 1872, nearly two hundred separate accidents came under his own knowledge, causing the death of ten persons, and injury to thirty-three others. The lightning struck sixty houses, fifteen of which were burned down, and killed twenty-three horses and cattle, and ninety-nine sheep. "This is," truly remarks Mr. W. H. Preece, commenting upon the figures, "the imperfect record of only two storms. What must it be for the whole year?"

I can vouch for it as an actual fact, ascertained by myself on a quite recent visit, that several portions of the noble pile, among them St. George's Chapel, home of the illustrious Order of the Garter, and the adjoining Belfry Tower, overhanging the main street of Windsor town, are entirely unprovided with lightning conductors. On other parts of the Castle a few conductors are placed, but clearly not enough. It is needless to say that, speaking only of St. George's Chapel and the Belfry Tower, these splendid ancient structures, in their exposed situation, constantly touched by the storm-clouds that sweep up the valley of the Thames, are liable at any moment to destruction, with irreparable loss to the nation.

If the entire absence of lightning conductors is the most prevailing cause of the still exceedingly great number of casualties occasioned by lightning, that of ill-placed or insufficient conductors is another deserving much attention. The mischief done in this case is not only that the conductor gives a false security, but that, should the dwelling on which it is placed be struck by lightning, it leads to the belief that the wonderful scientific discovery of Franklin is nugatory, or at least uncertain in its action. Only on this ground can it be explained that there are still a great many persons with no faith in lightning conductors, who have heard, or read, of instances in which buildings provided with them have suffered from lightning. In all these instances, and they are, it must be confessed, rather numerous, a careful investigation of the whole facts and circumstances invariably shows that the lightning conductor was not at fault. On the contrary, it is absolutely and invariably certain in its action, provided that it be properly placed, not neutralised by other forces, and have a good "earth connection."

I now come to the third cause of neglect, which, though ranged as the last, is by no means the least. My argument is that lightning conductors ought to be at regular intervals, at least once a year, carefully inspected, and their efficiency tested by a galvanometer. The absolute neglect of this precaution which is now prevailing is, I believe, the cause of a vast number of casualties by lightning, inflicted upon buildings nominally protected by conductors. Exposed as they are to all the destructive influences of wind and weather, and the often still more pernicious assaults of ignorant workmen, masons, bricklayers, and others, who, while undertaking repairs, tear down ruthlessly, as a nuisance, the wonderful yet fragile string of metal which leads the electric flame on its path, it but too frequently happens that persons who have had the wisdom to erect lightning conductors over their houses, and believe themselves fully protected, are in reality far worse off than being without a conductor. But utter neglect of the conductor, when once it has been put in its place, is the commonest thing, and indeed the rule, as regards private dwellings; and, I fear, there is little difference in this respect as to most public buildings, churches, and chapels. In fact, it is the old case of a matter, however consequential, yet being utterly disregarded as "nobody's business." Other repairs to all sorts of public buildings are regularly executed: the walls are kept safe; painting and whitewash are renovated from time to time; the roof is preserved watertight; and the turret-clock, if there is any, is thoughtfully looked after, oiled, cleaned, and repaired. But who is there that ever inspects the half-hidden little thing on which the safety of the whole fabric against the destructive effects of lightning depends? I made a great many enquiries on this highly important subject, and the more I did, the more I was surprised at the profound negligence generally prevailing about it. Between three and four thousand pounds were spent in protecting the Houses of Parliament by lightning conductors at the time of their erection, some twenty years ago. Since that time, as far as I can learn, after minute investigation, they have never been tested, and there is no guarantee whatever that a discharge of lightning may not at any time fall upon the Queen's throne, the Lord Chancellor's wool-sack, or the Speaker's chair. As regards Windsor Castle, already referred to, the case is even worse. While parts of it are entirely unprotected, it is excessively doubtful whether the few conductors placed upon some of the

eminences of the vast range of buildings are at all efficient, and not merely "a delusion and a snare." It is well known that the all-important matter in respect to a lightning conductor, and the principal element of its efficiency, is the "earth connection," that is the immediate and complete dispersion of the electric force, after it has made its way from the clouds through its metal path, in the ground below. Moist earth is indispensable for the purpose, and I am very sceptical as to whether the few rods that stand over the Queen's private apartments at Windsor Castle, and the culminating mass of stonework—the Round Tower—actually have their root in moist earth. If not, it would certainly be better if the things were taken away altogether, and the whole magnificent structure treated like St. George's Chapel and the Belfry Tower. A French writer pithily expresses the results that follow from a lightning conductor over a house not having a proper "earth connection," by saying it is lightning guided to the owner's iron bedstead.

Having drawn attention to the chief causes of the numerous and fatal casualties caused every year by lightning, I have only to add a few words of advice as to how they might be prevented, or at least greatly diminished. First of all, I think it most desirable that public recommendation should be made, by local and other authorities, to place lightning conductors on all exposed or high-lying buildings, whether public or private, as well as on those standing near woods and on moist ground. It might be well worth the trifling expense to place simple conductors also against trees in parks, under which there are benches, or where persons are likely to gather during a thunderstorm, they forming a prolific source of fatal accidents. Above all, no church, chapel, school, prison, or other large public building, ought to be without one or more lightning conductors. There can be no excuse whatever for omitting this simple protective means against death and destruction, which may come at any moment, in the case of edifices devoted to public or national uses. But if it is necessary to greatly multiply lightning conductors, it is equally so that they should be planned and erected by competent persons, with scientific as well as practical knowledge of the work. There are a hundred circumstances which ought to be taken into account in selecting the best position for conductors, especially on large buildings and those of irregular construction; and only great experience, as well as cognition of all that we know about the movements of the electric force, can accomplish it. Of first importance are the considerations of the general design of the building that is to be protected; the soil on which it stands, whether dry or moist: the presence of masses of metal in or near the roof or the walls, as in the case before mentioned; the position of the chimneys; and similar matters affecting the course of the electric discharge of the clouds. It would be quite impossible to lay down absolute rules on the subject; still protection against lightning may be effected with the greatest certainty, under the guidance of well-known facts and observations which throw light upon the undeviating path of that mysterious electric force. But if everything possible has been accomplished towards the erection of the most perfect lightning conductor, there still remains something to be done. It is, not only to construct a faultless conductor, but to maintain it always in good condition. This is a matter which, sadly neglected, and overlooked to an astounding degree, cannot be too much insisted upon. It ought to be universally known that a lightning conductor is worth nothing unless it is periodically tested. The testing should take place at regular intervals, perhaps best in the spring, before the advent of the summerly thunderstorms, and it should likewise be made whenever a building has been undergoing repairs which may have damaged the conductor. A well organized system of inspection of lightning conductors would be most inexpensive. The galvanometer used for the purpose has been latterly much improved in Germany, and small portable instruments, of the size of a diminutive carpet bag, are now made, which leave nothing to be desired in the way both of effectiveness and durability. As the clocks in churches and other public buildings are methodically inspected by the clockmaker, so ought every lightning conductor to be as

systematically examined by an electrician or other competent person. Already such a system of inspection and testing of conductors exists in Paris and several other French towns. Shall we say, once again, "They manage these things better in France."

REPORT OF THE COMMITTEE ON ATMOSPHERIC ELECTRICITY.

The report stated that the committee has purchased three electrometers. These have been given—one to Surgeon-Major Johnson in India; the second to Mr. Michie Smith in India; and the third to Dr. Grabham in Madeira. Surgeon-Major Johnson was engaged in the frontier war in India; and Dr. Grabham has hitherto been too much occupied to make observations; while Mr. Michie Smith has not yet had time to furnish any; so that up to the present time no observations have been received. The committee feel confident of obtaining results from Mr. Smith, and hope also to receive reports from the other observers, but in the event of their being unable to furnish regular observations, the committee would get the electrometers back, and make them available for other persons.

SUN-SPOTS AND RAINFALL.

BY C. MELDRUM, F.R.S.

The conclusion at which the author arrived from a great number of observations in all parts of the world was that the maximum and minimum rainfall apparently coincided with the maximum and minimum sun-spots respectively.

THE TEMPERATURE OF THE EARTH WITHIN.

Mr. W. Morris read a paper on this subject. He held that the present method of determining underground temperatures with the thermometer as used in air or water was quite unsatisfactory. He suggested the employment of pairs of chronometers, one of each pair to be placed at the bottom of a bore, and the other at the surface, so that by the difference of their rates the mean temperature might be accurately ascertained.

ON CERTAIN PHENOMENA ACCOMPANYING RAINBOWS.

Professor Silvanus P. Thompson narrated several instances of rainbows, chiefly seen in Switzerland, when radial streaks of light, devoid of colour, were observed within the primary bow, and without the secondary bow. The explanation of these convergent rays was suggested by analogy with the divergent beams that are often seen breaking through the clouds at sunset!

REVIEWS.

Sanitary Examinations of Water, Air, and Food: a Handbook for the Medical Officer of Health. By CORNELIUS B. FOX, M.D., &c.
London: Churchill. 8vo, 19-508 pages.

A CONSIDERABLE portion of this work lies beyond the field of criticism for this journal, and though very interesting and very useful, we are bound to pass it by. Meteorology and sanitary matters are, however, inseparable, and it is therefore natural that a considerable portion of Dr. Fox's work should be devoted to Meteorology. Dr. Fox is well known as the author of the best book upon Ozone in any language: his position, therefore, renders the following paragraph as important as it is amusing:—

"It was formerly the practice to employ starch tests, which are composed of a mixture of iodide of potassium and boiled starch, which became blue on

exposure to the air from the formation of the blue iodide of starch. There are many different kinds, which may be looked upon now as curiosities—for example : Schönbein's, Lowe's, Jame de Sedan's, Lender's, Moffat's, &c. They are all more or less disposed to play mad pranks ; now they colour, then they bleach ; sometimes they tint in a uniform manner ; at other times they become marked with lines, like a Scotch plaid, or with spots ; whilst they very frequently fade. Hence the records of observations appear most contradictory, forming a mass of almost inextricable confusion. In support of this assertion, the opinions of a few who have made ozone a subject of study may be quoted.

“ ‘At the present time the modes of determining ozone, and the tests for ozone in the external air, are very unsatisfactory.’—*Dr. Richardson*.

“ ‘The greater part of the countless observations on the amount of ozone in the air are worthless.’—*Professor Heaton*.

“ ‘The determinations which have hitherto been made are very vague and unsatisfactory.’—*Dr. Wetherill*.

“ ‘Tests prepared from the same recipes by different persons give varied results.’—*Boehm*.

“ ‘If we expose the tests of Schönbein and Moffat together we do not get the same result, and even tests made by the same persons at two different times will not read alike.’—*Mr. Lowe*, of Nottingham.

“ ‘All the methods employed are more or less defective.’—*Dr. Scoresby-Jackson*.

“ ‘Until more certain means are discovered for estimating ozone, present observations must be received with great caution.’—*Davies*.

“ ‘The estimation of ozone is in a very unsatisfactory state. The great imperfection in the tests makes it desirable to avoid all conclusions at present.’—*Professor Parkes*.

“ ‘No clear and consistent results have yet been obtained. Variations of light, wind, time and paper may cause changes attributed only to ozone, and there are no reliable means of checking them.’—*Admiral FitzRoy*.

“ ‘No trustworthy observations on ozone are made in the United States of America.’—*Dr. Henry*, of the Smithsonian Institution.”

The relations between meteorology and disease are fully detailed, chiefly on the basis of the researches of Mr. Buchan and Dr. Mitchell.

Part IV. is entitled “Mode of observing Meteorological States and Variations in the condition of the Air” ; it occupies nearly 50 pages, is fully illustrated, and very useful. We shall probably render the greatest service by picking out statements with which we do not agree.

Respecting the thermometer attached to the Fortin barometer, Dr. Fox says “the bulb of its attached thermometer should always enter the cistern.” We thought that this old notion had long been dissipated. The attached thermometer is needed to tell us (1) the temperature of the scale upon which the barometer inches are marked, and (2) to tell us the temperature of the column of mercury in the barometric tube. Both of these data are more accurately given by a thermometer half-way up the brass tube and opening directly to the barometer tube, than by the old plan of burying the bulb in the cistern.

On p. 367 Dr. Fox sketches and describes a form of thermometer stand as the “Meteorological Society's Stand,” but the Society have had all their stations provided with Stevenson's pattern, and the modification of Stow's represented by Dr. Fox is quite a rarity. We believe, however, that it is quite as good as a Stevenson.

Dr. Fox is very severe upon the inaccuracies of thermometers, and we do not object to severity upon such a subject, but we believe that

nearly all the faults quoted are explainable by his own statement of "the tendency which thermometers have to read higher from age."

With respect to Dr. Prior's criticism on clinical thermometers, as quoted by Dr. Fox, we bring together two sentences, which are separated by about a page :—

"Dr. Prior, of Bedford, in a paper on 'The Thermometer in Disease,' read before the South Midland Branch of the British Medical Association in 1867, relates an experiment of comparison which he made with five thermometers, three of them being medical instruments. He placed them all in water at a temperature of 105° or 106°, and allowed it gradually to cool. The result is here given in his own words : 'No two of them precisely corresponded at any time."

* * * * *

"It is not by any means an easy matter to verify thermometers with precision. The verification can only be satisfactorily conducted by means of instruments specially adapted for the purpose, such as are to be found in the great observatories."

Dr. Prior's criticism is, therefore, valueless unless he possessed proper testing apparatus. If he had used such apparatus he would surely have mentioned it.

The chapter on Atmospheric Electricity is worthy of especial praise.

The Fenland, Past and Present. By S. H. MILLER, F.R.A.S., and S. J. B. SKERTCHLY, F.G.S. Wisbech: Leach & Son, 1878. Royal 8vo, 32-650 pp.

ENQUIRIES were rather frequent as to when "The Fenland" really would be published; those who have now obtained this handsome volume—token in itself of what Fenmen can do—will feel that while they were waiting, the book was growing and improving. Now that it is finished it is permissible to suggest that the next edition will be handier in two volumes, and that it might be better to throw all the history, ethnology, and archæology into one volume, and the geology, meteorology, botany, and natural history into the other. However, we have to deal with the book as it stands, and with the exception of a few lines we must confine our attention to the meteorological portion. In these general remarks we unhesitatingly affirm that the work is crammed with information, creditable to all concerned in its production, and will be indispensable to all future writers upon the subject. But we have also a fault to find. Out of 682 pages not one is devoted to Fenland Bibliography. Even if the authors had only collected into one page a list of their predecessors, to whom they refer in various footnotes, it would have been useful; but we believe that they could have done far more than that, and we trust that they will commence such a catalogue in readiness for their next edition.

As would naturally be expected, the chapter devoted to Meteorology, written by Mr. Miller, is long and good. It is, in fact, a summary of 15 years' regular observations at Wisbech, with the addition of abstracts of extra experimental researches on Solar Radiation, Evaporation, and other subjects. We are not going to write a long panegyric upon Mr.

Miller's devotion to his observations, or on the ability he has displayed in working them up. An observer with a reputation is expected to do such things, and we take it as a matter of course; and all our readers know perfectly well that for the best information as to Wisbech climate they must look to Mr. Miller, and we have said already that the chapter upon the subject is good. It is needless to say that it is not perfect, and it is our duty to point out in what respects.

First, then, we are puzzled by the following statement on page 232:—

"THE TEMPERATURE.—The *amplitude* of the monthly mean was $24^{\circ}1$ in 15 years."

Mr. Miller seems to use the word "*amplitude*" where meteorologists generally use the word "*range*"; but we cannot make the figures right: the hottest month (July, 1868) had a mean temperature of $66^{\circ}9$, the coldest (December, 1874) of $31^{\circ}5$, the extreme range was, therefore, $35^{\circ}4$. We thought that it might indicate the *average* range, but according to Table IX. that works out $27^{\circ}1$. Perhaps $24^{\circ}1$ is a misprint for $27^{\circ}1$.

We do not remember ever seeing a table of prevalence of fog, and are greatly astonished at the figures given in the present work. During November, December, and January there are on the average only two days with fog in each month! This is very droll; why instead of going to the Mediterranean to avoid the English November fogs one need only go to Wisbech; there will not be one foggy day in a fortnight.

The rainfall data are given very fully, and a few introductory remarks comparing the Fen values with those for other parts of the country render the subject easily followed by those previously unacquainted with it. The table of heavy falls in 24 hours is especially useful. On p. 237 "*Honington*" should be "*Honingham*"; most people would, however, recognize it as Lady Bayning's valuable station near Norwich.

Mr. Miller will, we hope, forgive us for treating as a scare-crow a paragraph in which he has committed no greater offence than that of following all the highest living authorities. The following is the paragraph:—

"The *elastic force* or *tension of vapour* is an expression of the statical force which vapour exerts on a column of mercury. As an illustration, suppose the barometer reading to be 29.9 inches and the *tension of vapour* at the time of observation 0.4 inch; then if all the vapour were withdrawn from a column of air extending throughout the atmosphere, the barometer would read 29.5 inches, and would thus represent the weight of a column of *dry* air. The *elastic force* is a measure of the *absolute* amount of vapour in the air."

Suppose balloons had not been invented, even then would or could anybody believe that the air at heights of 1, 2, 3, 4, 5, &c. miles is always in exactly the same hygrometric condition as the layer which is 4 ft. above the ground? Would anybody suppose that it is the same at 4, 40, 400, 4,000, and 40,000 feet? Besides, thanks to Mr. Glaisher, we now know that such a thing as a uniform hygrometric

condition from the earth's surface to the altitudes which he alone has reported upon never exists.

We have two instruments—one, the barometer, tells us the total weight of the atmosphere above it; the other, the hygrometer, tells us how much moisture there is in the air immediately surrounding it. This amount of moisture may be legitimately described either as the percentage of the total capacity of the air for holding moisture which is shortly expressed by the term "relative humidity," or it may be expressed as "elastic force" *at the place of observation*, but we cannot understand how any one can regard this value as indicative of the hygrometric condition of the atmosphere at a height of two or three miles. As we cannot know that the entire atmosphere above the barometer is in the same hygrometric state as prevails around the hygrometer, we regard all such definitions of elastic force as that given above as delusions and snares, as fictions with only a slender substratum of fact. If we are wrong we shall be delighted to be put right, but if we are not wrong we hope that an accurate definition of the term elastic force will be given.

Why will authors use grand words instead of those to which readers are accustomed? Meteorologists know that Mr. Miller has devoted much time and money to experiments upon evaporation; his heading of the subject is "Evaporation," and yet in the third line he tells us that "In the atmosphere of our globe two great processes constantly obtain, namely, *vaporization* and *condensation*." We have nothing to do with philology, and our stock of English dictionaries is limited, but Nuttall defines "Vaporization—artificial formation of vapour." We leave Messrs. Miller and Nuttall to settle whether "Vaporization" means the natural or the artificial formation of vapour. This, however, is a by-shot, and we are glad to conclude by saying that the section contains much entirely new information, especially respecting the evaporation from water, soil, peat, long grass, short grass, and red and white clover; also from sunflowers, cabbages, &c.

Sanitary Engineering: a Guide to the Construction of Works of Sewerage and House Drainage. By BALDWIN LATHAM, M.I.C.E., &c.
2nd edition. London and New York: E. & F. N. Spon. 32-559 pages, 8vo.

THERE are two reasons why we should not notice this book—(1) because it is rare for reviewers to mention second editions, (2) because it is not a strictly meteorological work. But there are stronger reasons for calling attention to it. We believe it to be by far the best book upon the subject, and it is virtually a new work, for it is two or three times as large as the first edition, which, by the bye, having been rapidly exhausted has led to copies being obtainable at only fancy prices. Though not a meteorological work, it is one which is largely dependent on meteorologists, for, as Mr. Latham truly observes,

“rainfall tables are of great importance and inestimable value to the engineer in designing works of sewerage.”

The historical notes on the drainage arrangements of the Jews, Greeks and Romans are very interesting. With reference to the latter we would advise Mr. Latham, when he can get an idle day, to run down to Silchester and examine the remarkable revelations of Roman life which are coming to light under the direction of the Duke of Wellington.

Before concluding, we wish to call attention to the fair and honourable way in which Mr. Latham gives to everyone the credit for what each has done. Some persons appear to think that by ignoring the old motto, *Palmarum qui meruit ferat*, they induce their readers to suppose that they are individually the *fons et origo* of all the knowledge afforded by their books. We think that they make a terrible mistake, and that with quotations, as with everything else, “honesty is the best policy.”

RATIO OF MAXIMUM DAILY TO MEAN YEARLY RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—Having for a long time held the opinion that the greatest amount of rainfall in any one day bears a direct ratio to the mean annual fall, I some years ago constructed a table for my own use in discussing the amount of flood water passing down the streams.

Lapse of time having shown it to be as accurate as anything based upon the eventualities of weather can be expected to be, and in the hope that it may be useful to some of your readers, I shall be glad if you can find a corner for its insertion.

AVERAGE ANNUAL FALL.		MAX. FALL IN ONE DAY.		
Inches.		Per cent. of Annual Fall.		Amount Inches.
20	.....	20	.....	4·0
25	.....	18	.....	4·5
30	.....	16	.....	4·8
35	.....	14 $\frac{1}{4}$	.....	5·0
40	.....	13	.....	5·2
45	.....	12	.....	5·4
50	.....	11	.....	5·5
60	.....	10	.....	6·0

Its practical bearing on Meteorology is to show that if a rain-gauge, read only once daily, does not hold the quantity shown in the third column, depending upon the mean annual fall at the place in question, a time will come when it will be filled to overflowing, with consequent loss of the register.—I am, Sir, yours faithfully,

EDWARD M. EATON, A.I.C.E., F.M.S.

Water Works Office, Sheffield, 5th October, 1878.

[WE are extremely glad to receive the above letter for several reasons, of which, however, we need only mention two or three. It

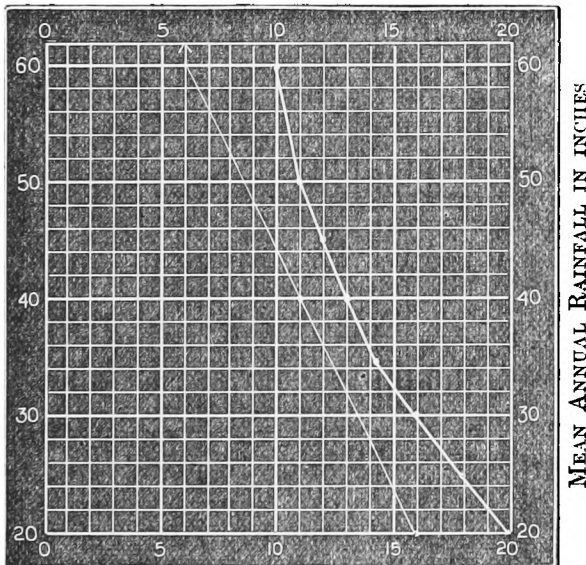
is always satisfactory when two computers working unknown to each other, and on different data, arrive at analogous results. The subject investigated by Mr. Eaton was mentioned eleven years ago in *British Rainfall*, 1867, on p. 79 of which work the following paragraphs will be found :—

“The extreme per-centage of the mean annual rainfall which may be expected on any one day is, with a mean fall of 20 inches, 16 per cent. ; the per-centage decreases 1 per cent. for each additional 4 inches of mean fall, until it falls to 6 per cent., and above that point (60 in.) it is constant at 6 per cent., whatever the mean fall may be.

Examples.	Mean Fall.	Per-Centage.	Computed Max.	Observed.
Retford ...	22 in.	15·5	3·41	3·10
St. Agnes..	42 „	10·4	4·41	4·00
Seathwaite	140 „	6·0	8·40	6·62

“The result of this rule is that there is no part of the British Isles where a fall of from 3 to 4 inches of rain in 24 hours will not occur, sooner or later. Wherefore observers are requested to ascertain the capacity of their rain gauges, and if they find it three inches or under, to provide themselves with one of larger storage.”

Mr. Eaton's values and those given by Mr. Symons in the above quotation are shown on the following diagram, and, for reasons which



PER-CENTAGE OF MEAN ANNUAL AMOUNT WHICH WILL FALL ON ONE DAY.

it would require too much space to explain fully, we have little doubt that Mr. Eaton's are nearer the truth than the others. But whichever is adopted there is one conclusion which is unavoidable, namely, that

observers should pay strict attention to Rule XVI, which is as follows :—

“XVI.—OVERFLOW.—It would seem needless to caution observers on this head, but as a recent foreign table contain *six instances on one day* in which gauges were allowed to run over, it is evidently necessary that British observers should be on the alert. It is not desirable to purchase any new gauge of which the capacity is less than four inches.”
—ED.]

SUPPLEMENTARY TABLE OF RAINFALL IN SEPT., 1878.

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

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	1·23	XI.	Castle Malgwyn	4·08
„	Littlehampton	1·97	„	Nantgwilt, Rhayader ...	4·81
„	Hailsham	1·41	„	Carno	3·73
„	St. Lawrence, I. of W....	2·08	„	Rhug, Corwen	2·12
„	Strathfield Turgiss	·69	„	Port Madoc	4·05
III.	Addington Manor.....	1·13	XII.	Carsphairn	6·36
„	Oxford	1·49	„	Melrose	3·31
„	Northampton	2·24	XV.	Gruinart	4·83
„	Cambridge.....	·75	XVI.	Grandtully .....	...
IV.	Sheering	1·02	XVII.	Tomintoul.....	2·82
„	Diss	1·32	„	Keith	2·67
„	Swaffham	1·87	XVIII.	Dalwhinnie	8·29
V.	Alderbury, Salisbury ...	1·54	„	Achnasheen	7·82
„	Compton Bassett	1·49	„	Springfield, Tain	1·96
„	Dartmoor	4·91	„	Glenfinnan	16·17
„	Langtree, Torrington ..	4·27	XIX.	Watten	3·66
„	Cosgarne, St. Austell ...	4·59	XX.	Glenville, Fermoy	3·38
„	Taunton .....	...	„	Tralee.....	3·69
VI.	Bristol	2·43	„	Tipperary	3·57
„	Sansaw	2·74	„	Newcastle W., Limerick	2·99
„	Cheadle	2·81	„	Kilrush	3·92
„	Bickenhill Vicarage.....	2·75	XXI.	Kilkenny	2·32
VII.	Coston, Melton Mowbray	1·27	„	Kilsallaghan	2·28
„	Bucknall	1·60	„	Twyford, Athlone	4·12
VIII.	Walton, Liverpool	4·02	„	Belvedere, Mullingar ...	3·95
„	Broughton-in-Furness ..	5·95	XXII.	Ballinasloe.....	3·37
IX.	Stanley, Wakefield	2·49	„	Kylemore	10·52
„	Mickley, Ripon	2·35	„	Carrick on Shannon.....	3·54
X.	Gainford	2·36	XXIII.	Rockcorry	4·29
„	Unthank Hall	3·57	„	Warrenpoint	3·04
„	Shap	5·88	„	Newtownards	2·80
XI.	Llanfrechfa	4·58	„	Bushmills	4·66
„	Solva	1·69	„	Buncrana	4·10

SEPTEMBER, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which .01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	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 .....	.83	— 1.43	.21	17	12	75.4	7	37.7	24	0	0
II.	Maidstone (Hunton Court)....	.87	— 1.25	.29	19	9	...	...	...	...	...	...
III.	Selborne (The Wakes).....	1.64	— .80	.48	17	11	70.0	6, 8	31.0	24	2	...	
III.	Hitchen .....	.96	— .90	.20	17*	12	68.0	5	37.0	23	0	...
IV.	Banbury	1.77	— .60	.62	7	15	72.5	5	31.0	24	1	...	
IV.	Bury St. Edmunds (Culford)....	1.40	— .21	.39	8	14	74.0	5	33.0	20	0	2	
V.	Norwich (Sprowston).....	2.72	...	.59	12	17	...	...	...	...	...	...
V.	Bridport	2.07	— .25	.67	22	10	...	...	...	...	...	...
V.	Barnstaple	4.03	+ .27	.80	22	16	78.0	6	46.0	23	0	...	
V.	Bodmin	3.14	— .53	.83	22	15	76.0	5	46.0	23	0	0	
VI.	Cirencester	1.73	— 1.13	.40	19	10	...	...	...	...	...	...
VI.	Shifnal (Haughton Hall)	3.03	+ 1.08	.66	8	15	70.0	5	35.0	24	0	1	
VI.	Tenbury (Orleton)	3.66	+ .98	1.00	22	14	73.5	5†	32.8	26	0	3	
VII.	Leicester (Town Museum)	1.82	...	.45	7	14	70.3	3§	33.6	24	0	5
VII.	Boston	1.57	— .00	.29	12†	13	77.0	7	38.0	24	0	...	
VII.	Grimsby (Killingholme)	2.72	...	.42	29	16	68.0	3||	40.0	21¶	0	...
VII.	Mansfield	1.54	...	.32	22	14	71.8	4	35.5	24	0	0
VIII.	Manchester (Ardwick).....	3.48	+ .30	.90	17	15	71.0	6	40.0	24	0	...	
IX.	York	2.67	— .34	.47	25	10	73.0	11	36.5	21	0	1	
X.	Skipton (Arncliffe)	6.63	+ 1.67	1.65	22	23	72.0	4	32.0	20	1	...	
X.	North Shields	1.68	— .02	.48	15	14	65.0	7	45.0	21**	0	0	
X.	Borrowdale (Seathwaite).....	15.06	+ 1.85	2.18	15	20	...	...	...	...	...	...
XI.	Cardiff (Crockherbtown).....	3.21	...	1.28	22	9	74.3	5	40.0	26	0	...	
XI.	Haverfordwest	3.24	— .47	.62	22	12	73.0	5	38.0	25	0	...	
XI.	Aberdovey	3.39	...	.75	22	18	80.0	11	43.0	21¶	0	0
XI.	Llandudno.....	3.75	+ 1.41	.71	29	16	73.2	5	43.0	24	0	...	
XII.	Dumfries (Crichton Asylum)...	3.20	+ .26	.97	23	18	71.2	5	37.0	20††	0	...	
XII.	Hawick (Silverbut Hall)	2.90	...	.70	15	17	...	...	...	...	...	...
XIV.	Glasgow (Cessnock Park)	4.80	+ 1.73	1.30	29	20	...	...	...	...	...	...
XVI.	Mull (Quinish)	6.58	...	1.08	15	25	...	...	...	...	...	...
XVI.	Loch Leven	4.00	+ .97	1.20	30	13	...	...	...	...	...	...
XVI.	Tyndrum (Ewick) .....	...	...	...	...	...	...	...	...	...	...	...
XVII.	Arbroath	3.34	+ .82	1.11	29	14	71.0	6	39.0	26	0	...	
XVII.	Braemar	5.03	+ 2.39	1.04	15	15	68.8	5	34.0	28	0	5	
XVIII.	Aberdeen	3.32	...	.99	29	19	72.1	3	38.7	26	0	0
XVIII.	Gairloch	6.00	...	.85	29	19	...	...	...	...	...	...
XVIII.	Portree	10.55	— .21	1.79	15	23	...	...	...	...	...	...
XVIII.	Inverness (Culloden)	2.89	+ .20	.75	30	18	71.9	5	39.9	21	0	0	
XIX.	Dunrobin	4.53	+ 1.76	.87	15	19	70.0	5	38.0	27††	0	...	
XIX.	Sandwick	5.90	+ 2.24	1.18	24	22	65.0	8	42.6	21	0	0	
XX.	Caherciveen Darrynane Abbey...	4.70	...	.73	20	23	...	...	...	...	...	...
XX.	Cork	3.15	...	1.50	22	13	...	...	...	...	...	...
XX.	Waterford	2.48	— .65	1.18	21	15	74.0	5	34.0	21	0	...	
XX.	Killaloe	4.46	+ .30	.66	21	19	80.0	6	34.0	23	0	...	
XXI.	Portarlington	3.17	— .11	.86	21	28	71.0	5	37.5	20	0	...	
XXI.	Monkstown, Dublin	1.70	— .29	.57	29	13	...	...	...	...	...	...
XXII.	Galway	3.65	...	.55	16	23	72.0	8	40.0	23	0	...
XXIII.	Waringstown	3.24	...	.85	29	18	75.0	5	38.0	22	0	...
XXIII.	Edenfel (Omagh) .....	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Ballyshannon	5.66	...	.80	24	18	...	...	...	...	...	...

* And 22. † And 29. ‡ And 6, 11. § And 6, 7. || And 4, 5, 9, 11.

¶ And 24. ** And 26. †† And 21, 22. ‡‡ And 30.

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

METEOROLOGICAL NOTES ON SEPTEMBER.

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.—A fine month for concluding the harvest and for hop-picking. Prevailing wind westerly; T & L on 8th; L on 23rd.

BANBURY.—High wind on 15th, 29th and 30th. T & L on 7th and 29th.

CULFORD.—Mean temp. of month 55°. Easterly wind on one day only, high wind from S.W. 15th to 18th. TS on 8th, and a severe TS about 6.30 a.m. on 30th, when a block of three cottages in the village was struck by L, and much shattered, the inmates fortunately escaping.

SHIFNAL.—Dry with one exception till the 8th, when there was a TS with heavy R, during a thick fog. From that day fine till the 15th, when R fell in the afternoon, followed by high wind at night from S.W., veering as usual to W. and N.W., and lasting the next day. On 22nd, heavy R again at night, and T and H at 2 p.m. on 23rd, from which date R fell daily with two exceptions till the close. Partridges very deficient, the eggs having been destroyed by the R in May. Still only a few red admiral and tortoiseshell butterflies.

ORLETON.—Several heavy falls of R during the month, which kept the land in a very wet state. In the intervals the weather was tolerably fine, and the temp. steady. Mean temp. nearly 0°·5 below the average; L and T early on the mornings of the 8th and 30th; and distant T on the 23rd. Strong wind on the 15th, 17th, 22nd and 30th.

LEICESTER.—Thunderstorms on the 8th and 30th.

BOSTON.—Harvest finished about the 14th, after a long and tedious ingathering, the quantity much below the average, and the quality very bad. The wheat seed was well got in during the dry weather of last autumn, and the season was favourable till May, which was wet and cold; the beginning of June was cold, the temp. on the night of the 15th falling to 38°. After this a period of bright warm weather set in, which completely restored the colour of the plant, and it was in ear about the 17th; the 26th of June and two following days were exceedingly hot, and the sun was very scorching, the max. in shade reaching 88°. A day or two afterwards a complete change occurred, the max. temp. of July 1st being 65°, a fall of 18° in two days, the temp. continued to fall, the lowest point (45°) being reached on the 4th; this sudden change of temp. affected the maturing of the plant at a critical time, and caused a great many blind ears. During August, while harvesting was going on, R fell on 18 days, which mildewed the corn and caused a great deal of sprouting, the wheat when finally harvested being in very bad condition. TS on 30th. Saturday, 28th, a.m., a very high tide, 15ft. 10in. above ordnance datum; wind very calm.

GRIMSBY.—First half of month fine and dry, the latter just the reverse. Horse flies extremely troublesome, and red admiral butterflies more abundant than usual. Faint T on 8th; TS on 30th. Harvest finished on 14th; stormy on 15th and 16th. High tide in Humber on 28th, but, being calm, no damage was done.

MANSFIELD.—Strong wind on 15th; T about 4 a.m. on 30th.

YORK.—Primroses in blossom by the middle of the month. Gale on 15th; T on 30th.

WALES.

ABERDOVEY.—Fine genial weather up to the 15th, when there was an evident change, as from that date it was more or less unsettled and stormy, although exceedingly mild throughout. T and L on the night of the 30th.

LLANDUDNO.—The first 14 days were fine, calm, and comparatively fair; but from the 15th to the 19th the weather was stormy, and the last day of the month was a thoroughly wet one. Mean temp. about the average.

SCOTLAND.

HAWICK.—Fine harvest weather up to the night of the 14th, when a hurricane set in from the W., doing much damage during the three days it lasted. The most beautiful lunar rainbow ever seen here was witnessed on the night of the 18th. The sky was almost entirely obscured by clouds; in the west there was a continuous bank of dark nimbus, over which the rainbow stretched. Seen from the Common Haugh, one limb seemed to rest on the Crumhaugh hill and the other on the Borthaugh hill. In the east the clouds were broken up, and as the moon appeared and disappeared between the rifts of clouds, the rainbow came and went. This continued for a considerable time, but after a heavy downpour of R it was no longer seen.

QUINISH.—A wet, unsettled month. Tremendous gale from S.W. to W. on 15th and 16th, with extraordinary R, from 9.30 to 10.30 a.m. on 15th.

BRAEMAR.—A very excellent month; crops all secured in first rate condition at an earlier date than for some 20 years. A violent hurricane on 15th.

ABERDEEN.—A month of rather fine warm weather; mean temp. $54^{\circ}9$, $1^{\circ}4$ above the 21 years' mean.

DUNROBIN.—Month, on the whole, fine and favourable for harvest operations. Gale from W. on 15th, 16th and 17th, many trees blown down.

SANDWICK.—A pleasant month till the 15th, when the barometer fell at midnight to 28.440 in., and immediately afterwards our equinoctial gales began blowing 50 miles or more most of the 16th, and 60 miles from 1 to 2 p.m. There was another gale of 50 miles an hour, from 6 a.m. till noon on 18th, doing much injury to that part of the crops that was uncut.

IRELAND.

DARRYNANE.—Another bad harvest month, constant small R with heavy showers at intervals. Wind almost constantly from W.

KILLALOE.—Weather not very favourable for finishing harvesting, but mean temp. high.

MONKSTOWN.—A very seasonable month, some days very cold. The extreme end of the month very fine and warm. A slight frost on the morning of the 21st. Very heavy R with L and T on night of 29th.

WARINGTOWN.—Very fine, warm and favourable for securing harvest until the last week. Crops secured in prime order.

BALLYSHANNON.—The month was marked by heavy rains and gales of unusual violence. On the 14th, a heavy gale from S., breaking down and uprooting trees and shrubs. Bar. fell suddenly to 29.22. On 15th, T and L; 16th and 17th, storm from W., with unusually high tides and hail showers.

THE WEATHER IN SEPTEMBER.

During the first week of September the changes in pressure were gradual and not extensive, no serious disturbance being recorded. For the first few days the weather was clear and bright, being a great improvement on the latter part of August; a good deal of fog, however, was recorded on most days from some places. In the first part of the week the area of highest readings was off our south-western coasts, and the lowest over the North Sea, so that N.W. breezes prevailed with low temperature. This distribution, however, gave way on the 2nd; the region of high readings during the succeeding few days passed slowly across France and our S.E. coasts and travelled on the eastern shores of the North Sea, whilst depressions passed northward along our western and north-western coasts, giving us southerly and south-westerly winds, with warm but rather showery weather. By the end of the week the area of high pressure was re-established over western France, the wind veered to the westward and temperature fell. Small amounts of rain

fell somewhere every day, and no thunderstorms of any importance were reported.

No important depression reached our coasts during the second week. On the 8th readings, though higher in the S.W. and lower in the N.W. than elsewhere, were very uniform generally, and light variable breezes prevailed. The next day there was a slight depression to the north-westward of Scotland, giving us fresh westerly winds; but this quickly passed away, and a large anticyclone lay over England, Ireland, and the north of France from the 10th to the 12th, very light airs prevailing over those countries, while breezes from the W. were reported in the north and from E. in the south. On the 12th the high pressure was again shown in the S.W., and a small disturbance, which advanced from the northward down our east coast, gave us a fresh northerly gale in the N.E. and a sharp squall elsewhere. On the 13th the bar. fell in the N. and W., and this fall extended to the whole of these islands on the following day. Readings highest over Brittany, lowest in the neighbourhood of Christiansund; strong wind in south of Norway.

The third week opened with a very serious disturbance, a decrease of pressure of 0.8 in. had occurred during the night on our N.W. coasts, and over the whole of these islands the mercury was falling briskly. Readings were highest over France, and gradients were very steep. Wind was S.W. to W. on our coasts, and while strong generally, reached a fresh gale in the N. of Scotland and at Valentia. During the 16th the disturbance passed slowly away eastward, and hard westerly to north-westerly gales prevailed over the greater part of our islands. In its rear the barometer rose quickly, but the recovery was of short duration, for on the night of the 17th and morning of the 18th the barometer was falling everywhere, with strong westerly to south-westerly winds, and rainy weather over England. On the 19th the barometer rose everywhere except in Sweden, but in the evening it fell again in the south, though rising in the north. This change continuing, high pressures were established in the W. and N.W., and northerly breezes prevailed on our coasts, with a brisk fall of temperature, and fair, dry weather. On the 21st a large area of high pressure lay over England, Ireland and France; the weather was fine and bright generally, and the barometer rising with light breezes except at Valentia, where a fall had commenced with a south-south-easterly wind. This fall became brisker during the day and extended to all Western Europe, while the wind in the S. of Ireland rose to a fresh gale from S., with wet, gloomy weather, the change gradually spreading eastwards towards evening. The fall continued on the 22nd, except over Scandinavia and Denmark, the change in the west amounting to about half-an-inch. A large depression lay over the N.W. of Scotland, and a small subsidiary one to the S. of Ireland. At the same time the area of high readings was shown over North Germany; in consequence southerly winds, ranging from a light breeze to a fresh gale, prevailed over these islands. The depressions moved south-eastwards, and on the 24th, when the bar. was rising everywhere except in North Germany, the area of lowest pressure was shown in the S.E., while readings were relatively high over the Baltic, off the W. coast of Ireland and in the S.W. of France. On the 27th and 28th the bar. rose everywhere; an area of high readings lay over France, and pressure was very uniform over these islands. On the following day pressure increased somewhat in the N. and E., but decreased in the S. and W., and over France. On the 30th a well-marked depression advanced from W. to E. across these islands, while the bar. began to recover again in the W. and S.W. During the last ten days of the month the changes in temperature were considerable and frequent, and rain fell very generally.

W. E. M.

A detailed technical illustration of a mechanical instrument, likely a chronograph or time-measuring device. The device features a large circular dial with a hand, a vertical scale, and a horizontal scale. The instrument is labeled with various letters (A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z) and includes a small inset showing a detailed view of a component labeled 'R'. The name 'J. BLANAUDET' is visible on the right side, and 'E. CHAUVEY' is visible on the left side.

E. CHAUVET

S Y M O N S'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLIV.]

NOVEMBER, 1878.

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WHIRLWIND AT WALMER, KENT, OCTOBER 24TH.

To the readers of this Magazine, records of terrible destruction by whirlwinds, even in England, are by no means unfamiliar. It will be convenient to give references to some of the most important ones—

Bruce Castle, Tottenham.....	Vol. III., p. 87.
Wantage.....	„ VII., p. 128.
Newbottle, Banbury	„ VIII., p. 149, 167.
Baldock	„ X., p. 83.
Cowes	„ XI., p. 121.
Ware	„ XII., p. 43.
Guildford	„ XII., p. 122.
Bodenham, Herefordshire	<i>British Rainfall</i> , 1872, p. 63.

Another must now be added to the list, and a very costly one too, for its path ended over a thickly built locality, and the ruin of house property has been excessive. We have neither time nor space to write the full record of the disaster, and must, therefore, content ourselves with reprinting the best general description which we have seen, and giving a short abstract of the results of our own personal examination and measurements of the damage.

We may also mention, as a preliminary, that a dozen or more extremely good photographs of the damage have been taken by Mr. Franklin, of Deal, and that copies may be procured of him.

Now for the epitome of the facts. It is reported that a few trees were damaged at the village of Whitfield, which is five miles S.W. of Deal, but although there is little doubt that this is true, we have not seen them, and, therefore, cannot place it among the facts. Its importance lies in this, that the village of Whitfield is exactly on the line of the path of the storm, and if damage occurred there it prolongs the track. This will be evident if we print the places passed over in their proper order.

S.W.	Whitfield.	Ripple.	Coldblow.	Walmer	Lower	Sea.	N.E.
Miles from				Court.	Walmer.		
Sea.	5·4	2·0	1·4	0·9	0·1	0	

We have spoken of the track as S.W. to N.E. ; its precise bearing was rather more westerly, or from S. 54° W. to N. 54° E.

The breadth of the track was in no place less than 450 feet, and in none greater than 700 feet ; its least breadth, and perhaps the greatest

mechanical force, occurred at Walmer Court, which was the highest ground over which it passed, and near the middle of its observed path.

The central path is very nearly a straight line. From Coldblow to Atholl Lodge, Lower Walmer, is nearly one and half miles, and the central line is in no case 100 feet away from an absolutely straight line joining those two places.

The duration assigned to the phenomenon by the editor of the *Deal Telegram*, "one or two minutes," is singularly confirmed by a rather droll calculation. A coach leaves Deal for Dover about 1.5 p.m.; on the day in question a fly followed the coach, and the proprietor of both noticed that when the coach passed Ely House (which was then intact) the fly was a quarter of a mile behind; before the fly reached the spot, the whirlwind had swept across, and all the damage was done. If we assume that the vehicles were going six miles an hour, it is evident that the interval between the passage of the vehicles was $\frac{1}{4}$ th of an hour, or $2\frac{1}{2}$ minutes, but this must be much in excess of the duration, for had either the coach or the fly been in the track, it would certainly have been carried up into the air. Our own impression, which must be taken *quantum valeat*, is that the duration was less than one minute, because usually these whirlwinds travel about 20 miles an hour, and with an extreme diameter, as we have shown, of 700 feet, it would only last 24 seconds. Since working this out we have noticed the last statement in the *Deal Telegram*. "We have heard several persons state that the whole mischief was done in less than a minute." Probably our calculation is not far wrong after all.

The newspaper report, though evidently hurriedly written, is extremely accurate; we have, therefore, reprinted it verbatim, taking, however, one liberty with it, viz., that of re-arranging the paragraphs so that they may follow as nearly as possible the path of the whirlwind. There is one expression to which we cannot quite assent, viz., that in which it is said "a portion of the cyclone appears, &c.," but as we are ourselves rather puzzled by the small damage done to the buildings at the S.E. corner of the barracks, the editor may, perhaps, be complimented upon having started the hypothesis of bifurcation.

We cannot hope fully to explain to our readers without engravings and a map this solitary point upon which we are at issue. But roughly the facts are represented by the following words and lines expressing the damage done on a line crossing the track of the storm S.W. of Lower Walmer.

A	B	C	D	E	F	G	H
---	---	---	---	---	---	---	---

A—N.W. boundary of injury.

A to D—A brick wall 7 ft. high, 14 in. thick.

B to C—86 ft. of this wall blown down.

D to E—Cells belonging to the Barracks, not much injured.

E to F—Turnpike road.

F—Ely House, terribly damaged, roof off, &c.

F to G—Houses much damaged.

G to H—Houses slightly damaged.

H—S.E. boundary of injury.

As the spaces B C and F G are those where injury is most manifest, it is not surprising that the hypothesis of bifurcation should have been started. As, however, the damage behind C F is at least equal to that behind B C, F G, we think that some other explanation of the partial immunity of the small building at D E must be sought. It is just possible that it was too strongly built to yield readily even to the force brought to bear upon it. We hope to have some information respecting its structure, so that we may have arrived at the solution before our next issue.

The report says nothing of what occurred at Coldblow—we, therefore, epitomize it. An ornamental clump of young oaks, about 200 ft. S. of the house, was completely spoiled; some have been wrenched round, others pulled up, and others broken off. A tub, about 3 ft. in diameter, and 2 ft. deep, which was about two-thirds full of water, was lifted up, and carried about 100 ft. N.E. The clothes lines of iron wire were broken from the posts and the loose ends twisted round the posts, and one of the iron stays to the post disappeared altogether. Many trees were broken, and the roofs much shaken. Slates from Walmer Court were blown 3,400 feet, and the rigging of some vessels in the Downs, about $1\frac{1}{2}$ miles from the shore, was encumbered with hay and straw, and we believe, in one case, a branch of a tree fell on the deck.

SEVERE GALE AT DEAL AND ALARMING CYCLONE AT WALMER.

Soon after daylight on Thursday, October 24th, a strong southerly breeze commenced, which had been preceded by a moderate "south-wester" during the previous day and night, and had caused a considerable number of vessels to take shelter in the Downs, which a few hours, before were nearly deserted. By ten o'clock the sea assumed a very boisterous appearance, and the wind increased to a gale from the south. From noon till one o'clock the gale increased almost to a hurricane, with torrents of rain. About five minutes after one the gale increased to what we think it no exaggeration to designate a cyclone, the force of which fell upon and inflicted most serious damage to property at Walmer. The destruction that has taken place in the short space of about one or two minutes (which was the utmost length of time it lasted) is almost incredible. Houses were unroofed, chimneys blown down, windows and window frames blown in, trees torn up, and in some instances the gable ends of the houses blown out.

The cyclone approached from a south-westerly direction; the first visible effects of its destructive character were felt at Walmer Court, the residence of Mr. Page, where the havoc it has made must be seen to be comprehended. The farm buildings are many of them completely destroyed and others mere wrecks. The destruction among the trees is of a most extensive character, some uprooted entirely, others of considerable size snapped off short, branches of immense dimensions are scattered all over the premises. The dwelling-house has happily escaped with comparatively slight injury, the lead of the roof being turned up, a chimney or two at the back blown down, and partially stripped of the slates. The destruction among the stacks and farm buildings is of considerable extent and value. As far as we were able to glean the particulars the following will be found pretty correct. The implement-shed, which stood at the south-west corner of the farm, had a boarded and felt roof. The latter was blown over a wall and across the bullock-yard, with a great deal of the *debris* of the building. The bullocks appear to have escaped unhurt. One sheep was killed, and two received such injuries that they were

immediately slaughtered. Three Christmas lambs were also slaughtered from a similar cause, and some of the Christmas sheep were buried in the ruins. All the bullock-lodges in the back-yard are destroyed, also the cart and waggon lodges. One most extraordinary circumstance we observed was eleven elm trees in one hedge row, all nearly together within the space of about forty yards, some on the top of each other in the wildest confusion. The fir trees are thrown in different directions, as much as fifty yards from the stumps, and one tree of large dimensions was blown completely over a wall, one portion resting on the wall, the stump being left in the ground. The lead is blown from the ridges of the roof of the out-buildings and stalls. A pea and wheat stack completely destroyed; the contents were scattered and blown with the force of the gale down as far as the South Barracks. The thatching of other stacks are nearly all more or less damaged, some completely torn off. A large lodge about the middle of the premises, in which were bullocks and colts, the thatch was stripped off and the building otherwise damaged. The carpenter's saw-lodge was blown down and the roof taken off the riding-horse stable. The groom and one of the farm servants sustained some serious injuries from the broken slates, tiles, and glass that flew about in all directions like feathers. It was a fortunate circumstance the storm was preceded by a heavy shower, so that many of the men employed on the farm had taken shelter in some of the buildings, or had they been exposed to the fury of the storm it would have been almost impossible to have avoided being injured by the falling *debris* from the trees and buildings. The front carriage-way to the Court was completely blocked with fallen trees and broken timber, which men were engaged clearing away during our inspection.

The cyclone appears to have passed Walmer Court across the field on the west side of Walmer Hill towards the South Barracks, where it threw down between thirty and forty yards of the strongly-built barrack wall facing the south, and then crossed the turnpike road towards Palmerston Villas, taking off the roof of Ely House, carrying away the stacks of chimneys off and sending them through the roof of No. 4, in the occupation of Mrs. Somerville, who it appears was fortunately absent, but the servants remained in the house, and it appears almost miraculous how they escaped with their lives, every floor being crushed and carried through to the lower apartments, carrying the furniture together with a valuable grand pianoforte, right through the building into the kitchen. The whole of the front windows in both houses were blown in, and some cottages at the back were also greatly damaged from falling chimneys and the force of the wind, and were so much shaken as will to all appearance necessitate their being rebuilt. All of the Palmerston and Clarence Villas have suffered either from loss of chimneys, broken windows, lead and slates blown from the roofs, &c. Some idea may be formed of the force of the wind from the fact that a chimney-pot was found among the shrubs in the Archery Ground on the opposite side of the road. The house of Capt. Royse, R.N., on the same terrace, has nearly all the glass of the front windows blown in. It appears that Capt. Royse was sitting reading his newspaper in one of the front rooms, when the panes were dashed in in a moment, and the far end of the room strewn with the fragments of glass, slates, &c.

After making its way through the barrack wall, a portion of the cyclone appears to have passed through the gateway of the principal entrance, and crossing the turnpike road up Cambridge-place towards the sea, where, as well as Palmerston-villas, the principal force appears to have culminated. In passing through the barrack gate it overturned the sentry-box with the sentry in it, who lay there till some one came to his relief. He escaped with a few bruises and a crushed helmet.

Mr. Barnes, "Cambridge Arms," had some of his front panes broken and a small shop-front at the side completely wrecked. This house is directly opposite to the Barrack entrance, through which the cyclone made its exit to the sea.

The south door of the "Cambridge Arms," which was shut and latched, was

blown in with such force that it drew the screws of the box staple of the latch and wrenched them off, and forced open an inner door which was also latched, twisting the lock as if it had been forced by a burglar's "jemmy"; bolts, latches, and locks afforded no security where the premises were exposed to the full force of the gale.

Richborough-villas and Alexandra-terrace, although not to so great an extent as Palmerston-villas, have received considerable damage from windows being blown in, lead curled up and taken from the roofs, chimney pots blown down and panes of the back windows of most of the houses demolished facing the south.

The most serious and alarming case in this neighbourhood has still, however, to be narrated. The two houses in Cambridge-terrace, which have been erected but a few years (four or five stories high) one the property of Mrs. Spickernell, the other of Mr. Knight. The gable end of Mrs. Spickernell's faces the east and the other the west, but they are both forced out, although at opposite points of the compass, laying open to view the staircases and bedrooms, leaving the houses in such a dangerous condition that they cannot be occupied; the furniture and contents are being removed as we write. The Granville Arms has been partially unroofed, chimney-pots destroyed, and other damage done. The whole side of one of the Douro Cottages has also been forced out (although in a sheltered position) and the panes are also shattered in most of these cottages. Several cottages at the back of Grove-lane have come in for a heavy share of loss, all being dreadfully shaken and partially unroofed. But the heaviest sufferer in this portion of the wreck is Mr. Trollope, a builder, who has a dwelling-house and extensive work-shops adjoining, all newly erected at the back of the terrace; these have come in for a double share of the destruction that has been dealt all round. It is only remarkable that so little personal injury has been inflicted from so serious a calamity, which is attributable no doubt in a great measure to several of the inmates of the houses being out, and it having occurred in the daytime. Had it been a night visitation, the consequences must have been most serious. Some estimate of the force of the wind may be formed by the fact that a large piece of timber, nearly 40 ft. long, was blown from Ely House into the sea. Mr. Woodcock's workshop and stables at the back of Cambridge-terrace were left a perfect wreck.

On the terrace fronting the sea scarcely a house has escaped except Mr. Fleet's terrace house, facing Walmer Road, which appears to have sustained no damage whatever, whilst the next house has sustained somewhat serious damage to the roof and some panes of glass blown in at the back, from which it appears that the cyclone terminated at that point and passed off over the sea, which for a few minutes obscured the shipping in the Downs from the spray it raised. In its passage from the land to the sea it took up a considerable sized boat from the beach into the air and carried it some distance out to sea, but we have heard that it has been since recovered.

The damage to the Terrace Houses has been confined principally to the back premises. The houses of Col. Green, Mr. Fleet, Mr. Roget, Mrs. Northcote, Capt. Douglass, Miss Blackburn, Mrs. Hassall, Mr. Kelly, and the Belle Vue Houses have all suffered more or less from the effects of the storm, either from chimneys blown down, being partially unroofed, broken windows, trees torn up, gates and fences blown in, or other casualties.

The destruction was all accomplished within two or three minutes. One of the residents of Walmer Beach told us it was more like a bombardment than a gale. The roads all round the parts we have described were covered with the broken fragments of slates, tiles, window glasses, &c.

The spot has been visited by hundreds of the inhabitants, many of whom are struck with amazement at the destruction effected in such a short space of time. We have heard several persons state that the whole mischief was done in less than a minute.—*Deal Telegram*

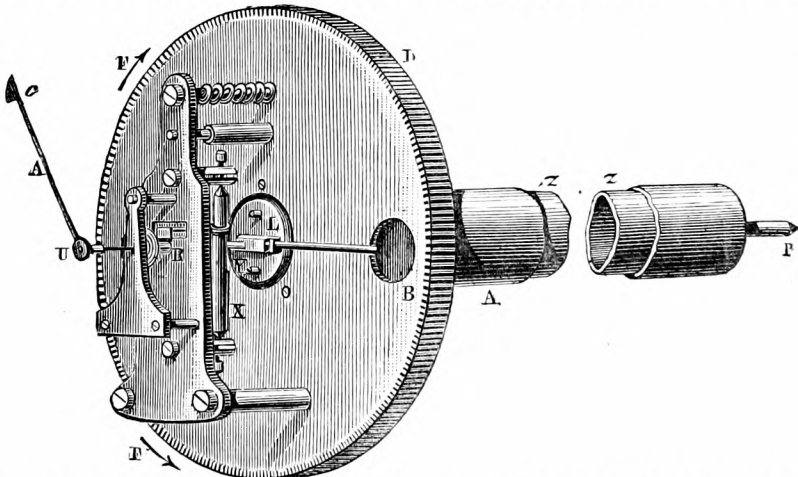
METEOROLOGY AT THE PARIS EXHIBITION.

(Continued from page 68.)

THE continued pressure on our space sufficiently explains the late period at which we are able to finish our notes.

In addition to the temporary **Montsouris Observatory** already mentioned, there was the **Meteorological Pavilion** on the north side of the river, which contained instruments, charts and books. The chief display of instruments was by **Redier**, and we think that they thoroughly deserved the reward they obtained, viz., the highest or Grand-prix. Nearly, if not quite, all the instruments exhibited by them were self-recording ones, on what may well be called the Redier system, viz., that of giving the instrument no work to do except to lift a trigger weighing at the most *two grains*. They exhibited a **barograph** on this system, already engraved by us*, and which we need not therefore explain; also a specimen of their **large dial barometers** (5 or 6 ft. in diameter), such as are erected at the Bourse, at the Church of Saint Eustache (opposite the Halles-centrales), also at the Westminster Aquarium, and of which a specimen was exhibited at the Loan Exhibition of Scientific Instruments.

We must, however, pass to new things—first, to the **thermograph**. This is utterly different from any hitherto made, but will be easily understood by anyone who has mastered the arrangement of differential clock movement invented by Redier for his barograph, and fully described in the number of this magazine to which we have already referred. Englishmen have become so accustomed to regard glass tubes containing mercury or alcohol as the only form of thermometer,



that they will be slow to recognize the undeniable fact that these forms owe much of their popularity to fashion and facility of construction. However, be that as it may, Messrs. Redier have adopted for

* *Met. Mag.*, Vol. x. (1875), p. 33.

their thermometer a double tube of steel and zinc, and make the varying expansions of the two tubes the controlling power of their thermograph.

The engravings do not need much explanation. In *fig. 1*, A is the exterior steel tube (not $\frac{1}{16}$ th of an inch thick), Z is the interior zinc tube; the changes in the length of these tubes are by the multiplying mechanism Y X conveyed to the axis U and cause the thermometric needle A to rise or fall; B is a regulating screw to bring the indications into perfect agreement with an ordinary thermometer. Turning now to the *frontispiece*, and following the order of the alphabet, we have—

- A, the thermometric needle which, according to the temperature, does or does not hold upon the escapement V by the hook c.
B, regulating screw for adjustment of scale readings.
C, cylinder, carrying the paper on which the temperature is recorded.
D, toothed wheel, turned by the differential clock movement so as to keep the thermometric needle A always in nearly the same position.
E, the escapement, which is always going, and which tends to turn the wheel D in the direction of the hands of a clock.
F, the cord which, starting from the wheel P and therefore wound or unwound according as the temperature rises or falls, and draws the recording pencil to the left or allows it to be drawn to the right by the weight Q.
I, the recording paper.
K, the recording pencil, an ordinary lead pencil on ordinary paper.
M, key shank, for winding the clock of which E is the escapement.
N, " " " " " V " "
P, wheel, turned by the differential clock movement.
Q, counterpoise, keeping the cord F taut.
R, clock, driving the recording cylinder.
U, axis of the needle A.
V, quick fan escapement, going only when released by A.
Y, terminal wheel of the differential movement, and driving P.

The essence, then, of the instrument consists in the fact that the motive force is supplied by the clock-work ; the thermometric tubes have as little to do as the barometer in the barograph. Instead of troublesome photography one has only a pencil and a piece of ruled paper ; instead of terribly fragile thermometers some 3 ft. long, one has a steel tube ; and, finally, instead of costing £120, we suppose it would scarcely cost £30, but we have no actual knowledge on that point.

It is obvious that this mode of registration is applicable to all kinds of variation. And two others were exhibited, one a **recording weighing machine**, intended for experiments upon evaporation, and so delicate that when loaded with a quarter of a ton it is said to register to the 50th of an ounce, or one-half-millionth of the total

weight ; a burning candle will record its own consumption in a smooth continuous line. Another ingenious application was that of recording the readings of an electrometer constructed on the model of Sir W. Thomson's.

THE FENLAND.

To the Editor of the Meteorological Magazine.

SIR,—Will you allow me to make a few remarks on your review of "The Fenland, Past and Present"? (*Met. Mag.*, Oct. 1878, p. 135).

In corroboration of what is recorded in the book, I beg to say that a day's fog in the Fens is a rare phenomenon. But you quote only the averages. The table to which you refer shows that in Oct., 1863, 7 fogs were recorded ; in Nov., 1870, there were 8 ; and in Jan., 1864, there were 5. I may add that records of the prevalence of fogs are being made at different places in the Fens, and that we shall have further details in the future.

I would suggest that the Meteorological Society should take up the subject of *elastic force of aqueous vapour*, as the present definitions of this branch of meteorology are anything but satisfactory.

As regards the word "vaporization," I see nothing "fine" in it. The matter is made clear by what follows, thus: "By the action of heat, water on the surface of the earth is vaporized." I find the following definitions in "Webster's Complete Dictionary":—"VAPORIZE, to convert into vapor by the application of heat, whether naturally or artificially." "VAPORIZATION, being converted into vapor."

If there is a distinction to be made between *evaporation* and *vaporization*, it is that the former applies more particularly to quantity, the latter to the active principle.—Yours truly,

HORACE E. MILLER.

*Belle-Vue Park, Lowestoft,
October 29th, 1878.*

N.B.—Thus far in October (29th) fog has occurred at Lowestoft on two occasions, viz., on the 21st, from 5 a.m. to 9 a.m., and on the 27th, from 8 a.m. to 8.30 a.m. The fog bell at the Lowestoft Ness Lighthouse has not been sounded at all during October.

[We fail to see the utility of the above letter, but do not like shutting out replies to reviews. Here is the Reviewer's answer.—ED.]

The second paragraph only so far contradicts what I said as it contradicts its own opening statement. Mr. Horace Miller, throwing aside the averages, picks out the most foggy months ; he might have added that, according to the table, there was not a single record of fog in October, 1862, 1870 or 1872 ; none in November, 1863, 1865, 1873 or 1875 ; none in December, 1863 or 1875 ; none in January, 1866, 1870 or 1873. Out of 60 winter months 12 are absolutely without one record of fog, and in 20 it does not exceed one entry per month.

The third paragraph confirms what I said, and the fourth shows that which is well known, viz., that dictionaries differ.—THE REVIEWER.

LIGHTNING CONDUCTORS IN CORNWALL.

To the Editor of the Meteorological Magazine.

SIR,—I have read with deepest interest Mr. Anderson's papers on Lightning Conductors and Accidents by Lightning, and I fully endorse all he says touching the singular neglect in allowing buildings to remain unprotected from the destructive effects of the electric fluid. For nearly 40 years I have been striving to induce my friends to fix conductors to their houses, and not, I am glad to say, without some success. But my great object has been to get the beautiful towers of this country protected, and those who pass through Cornwall will see that my efforts have not been in vain.

The expense of an efficient copper conductor is so trifling, and the fatal effects of lightning so frequent, that we may well wonder at the gross negligence so well stated by your correspondent.

The Brigade Depot buildings have lately been erected here on a high, exposed spot, at a cost of nearly £50,000, and not a single lightning conductor has been fixed, though the attention of the Government was called to the subject!

I do not concur with your correspondent in his alleged necessity of frequently testing by a galvanometer the efficiency of lightning conductors, believing that when a copper rod is properly fixed it will need no looking after for a *century or more*.

I am, Sir, yours faithfully

JAMES LIDDELL.

Bodmin, October 18th, 1878.

[Remarkable confirmation of Captain Liddell's argument is afforded by the following paragraph. How long will people prefer risking their lives and large sums of money to paying £5 or £10 for a good conductor.—Ed.]

"For the third time within thirty years the tower of the parish church of Week St. Mary, North Cornwall, was on Saturday night struck by lightning and destroyed. A massive basement stone was thrown twenty yards from the tower, and all the corner stones were dislodged. It is stated that about £2,000 will be needed for the restoration of the church."—*Daily News*, Nov. 12, 1878.

SQUALL AT BRIGHTON.

To the Editor of the Meteorological Magazine.

SIR,—For the second time this year we have been visited with a singular squall. On the afternoon of September 12th I observed the sky becoming very dark in the N., and at 2.35 p.m. there was a violent squall. All the doors in the house were suddenly banged to and the windows rattled. In the street dust was whirled round in clouds. Temperature, which at 2 p.m. was 67°·3, fell by 2.50 to 57°·8, and at 3.15 to 56°·5.

This squall was very similar to the Eurydice squall on March 24th last. On that day, at 4.40 p.m., I observed the dust flying in clouds in the N. along the Ditcheling-road here. The sky in the N. suddenly became dense, and at 4.45 p.m. snow commenced and continued to fall until 6.5; from 4.55 to 6.0 the fall was very heavy. By 6.25 the sky had become cloudless. Temperature, which at 4.42 was $39^{\circ}2$, had fallen to $30^{\circ}5$ by 5.7, and to $27^{\circ}5$ by 5.25, making a total fall of $11^{\circ}7$ in 43 minutes.

During the 11 years I have kept a meteorological register I have never observed such singular squalls as the two before-mentioned, and it is particularly noticeable that both were characterized by sudden falls of temperature.—I am, Sir, yours faithfully,

FREDERICK E. SAWYER, F.M.S.

55, Buckingham Place, Brighton, 14th Oct., 1878.

HEAVY SNOWSTORM.

To the Editor of the Meteorological Magazine.

SIR,—In the closing hours of October and the first hours of November a remarkable snow-storm visited these parts.

At 10 p.m. on October 31st, after two hours of heavy rain, snow commenced falling. At 11 p.m. the air was thick with flakes of enormous size, and the gardens were already becoming white. By daylight on November 1st, when the fall had ceased, snow lay on the ground to an average depth of 4 inches. The effect upon the trees and shrubs was disastrous. Many of the evergreens were torn to pieces by the weight of the superincumbent mass, tall conifers (as the arbor vitæ) were bowed to the earth or broken off in the middle, and large trees (as the oak, elm and birch) lost many branches.

The total downfall of water, including the two or three hours' rain which preceded the snow and some slight showers earlier in the day, was 1.698 in. Of this about 0.9 in. was in the form of snow at the time of observation, but it is probable that about 1.4 in. actually fell as snow. Had none melted, therefore, and had the snow fallen and remained in a dry state, the depth should have been about 17 inches. But the ground was comparatively warm, and the air was above the freezing point, the minimum of the night being $32^{\circ}7$. Much therefore melted, and the rest lay close and heavy. On the trees less would melt than on the ground, and it seems likely that the mass which rested upon many of the branches was equivalent to some 12 inches of dry snow. Hence the destructive effects.

From what little information I have gathered I infer that the fall was very local. The general distribution of barometric pressure, as indicated by the published charts, gave scarcely a suggestion of such an occurrence. A centre of depression lay to the eastward of the North Sea, and northerly winds with a moderately high and rising barometer prevailed over the western parts of England. There may have

been a secondary depression central to this neighbourhood and too small to be figured in the charts, but no distinct evidence of such appeared either in the movements of the barometer, the rise of which was scarcely if at all interrupted, or in the direction of the wind, which (as far as could be noted) was light from north-west and north.

GEORGE F. BURDER, M.D.

Clifton, 8th November, 1878.

GREAT RAIN IN THE SOUTH-WEST OF IRELAND.

To the Editor of the Meteorological Magazine.

SIR,—My return for October is startling—4 in. of rain on the 7th. All the streams from Darrynane Abbey to West Cove, on the east, and to Waterville on the north, were tremendously flooded; beyond those points there does not seem, judging by report, to have been much flooding, nor, I conclude, any remarkable rainfall.

The river Finneglass, close to Waterville, was flooded to an extent no one remembers before; but the Currane or Waterville river, running from Lough Currane to the sea, was hardly flooded at all! The Finneglass joins the Currane just above its mouth, and a salmon weir crosses the latter *immediately above* the confluence. Though the Currane is fully three times the size of the Finneglass, yet the latter not only rose over the weir but overpowered the Currane, and the water was flowing back into the Lake!

The Coomnahorna river, and two small streams between it and this place, were tremendously swollen. Man and boy, I have spent, since I can remember, about 25 years here, but never saw any flood at all approaching to this.

Mr. Mahony tells me his fall at Dromore Castle, 18 miles E.N.E. (true) from this, was 0·78 in. on 7th; at a second gauge, three miles from Dromore among the mountains, it was 1·17 in.

Yours very truly,

D. O'CONNELL.

Darrynane Abbey, Caherdaniel, Killarney, Nov. 3, 1878.

LUNAR RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—A very perfect lunar rainbow was seen here at about 5.45 p.m. yesterday, the 10th. As I believe such phenomena are of comparatively rare occurrence, perhaps you may care to insert this note in your magazine. The weather yesterday (and to-day) is very showery and unsettled, barometer oscillating frequently, and temp. below the average. Rainfall in last 48 hours, to 9 a.m. 11th, 0·88 in.

Yours faithfully,

B. T. GRIFFITH-BOSCAWEN.

Trevalyn Hall, Wrexham, Nov. 11th, 1878.

ESTIMATION OF OZONE.

To the Editor of the Meteorological Magazine.

SIR,—In the paragraph you give in the *Meteorological Magazine* from Dr. Fox's "Handbook for the Medical Officer of Health," it is stated—"It was formerly the practice to employ starch tests, which are composed of a mixture of iodide of potassium and boiled starch," &c., &c., &c. Would you oblige by stating what is *now* the practice employed for estimating ozone?—I am, &c.,

T. MOFFAT.

Hawarden, Oct. 27th, 1878.

SUPPLEMENTARY TABLE OF RAINFALL IN OCT., 1878.

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

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	3·17	XI.	Castle Malgwyn	8·10
"	Littlehampton	3·93	"	Nantgwillt, Rhayader ...	9·17
"	Hailsham	4·50	"	Carno	7·01
"	St. Lawrence, I. of W....	3·42	"	Rhug, Corwen	5·85
"	Strathfield Turgiss	2·83	"	Port Madoc	5·56
III.	Addington Manor	2·14	XII.	Carsphairn	9·22
"	Oxford	3·20	"	Melrose	1·86
"	Northampton	2·26	XV.	Gruinart	6·21
"	Cambridge	2·02	XVI.	Grandtully .....	...
IV.	Sheering	2·60	XVII.	Tomintoul	3·19
"	Diss	2·05	"	Keith	5·37
"	Swaffham	2·78	XVIII.	Dalwhinnie	6·35
V.	Alderbury, Salisbury ...	3·53	"	Auchnasheen	6·32
"	Compton Bassett	4·30	"	Springfield, Tain	2·38
"	Dartmoor	9·79	"	Glenfinnan .....	...
"	Langtree, Torrington ...	6·49	XIX.	Watten	2·27
"	Cosgarne, St. Austell ...	7·52	XX.	Glenville, Fermoy	4·44
"	Taunton	4·85	"	Tralee	6·98
VI.	Bristol	6·14	"	Tipperary	4·99
"	Sansaw	5·06	"	Newcastle W., Limerick	5·78
"	Cheadle	3·35	"	Kilrush	4·35
"	Bickenhill Vicarage	3·07	XXI.	Kilkenny	3·19
VII.	Coston, Melton Mowbray	2·36	"	Kilsallaghan	1·76
"	Bucknall	2·27	"	Twyford, Athlone	4·06
VIII.	Walton, Liverpool	3·03	"	Belvedere, Mullingar ...	2·97
"	Broughton-in-Furness ...	6·29	XXII.	Ballinasloe	3·31
IX.	Stanley, Wakefield	1·79	"	Kylemore	8·41
"	Mickley, Ripon	2·33	"	Carrick on Shannon	2·76
X.	Gainford	1·48	XXIII.	Rockcorry	3·00
"	Unthank Hall	3·01	"	Warrenpoint	2·75
"	Shap	6·62	"	Newtownards ...	3·42
XI.	Llanfrehfa	6·35	"	Bushmills	3·61
"	Solva	4·31	"	Buncrana	6·69

OCTOBER, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "41 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.				Deg.	Date.			
											In shade.	On grass.	
I.	Camden Town	inches	inches.	in.									
II.	Maidstone (Hunton Court)...	1.99	— .60	.50	24	13	73.3	5	31.6	31	2	2	
III.	Selborne (The Wakes).....	2.59	— .40	.88	25	13	...	...	...	...	...	...
III.	Hitchen	3.97	— .24	1.27	10	14	65.0	5, 6	29.5	30	3	9	
IV.	Banbury	1.83	— .72	.37	24	17	64.0	5	30.0	29	3	...	
IV.	Bury St. Edmunds (Culford).	2.61	+ .18	.45	23	18	68.5	5	31.0	30*	3	...	
V.	Norwich (Sprowston).....	1.92	— .79	.37	21	14	67.0	5	26.0	29	4	5	
V.	Bridport	2.04	...	.38	24	15	...	...	...	...	...	...
V.	Barnstaple.....	3.43	— .60	.72	9	14	...	...	...	...	...	...
VI.	Bodmin	7.21	+ 3.09	1.08	25	20	72.0	6	37.0	30	0	...	
VI.	Cirencester	6.89	+ 1.57	1.04	25	20	70.0	5	37.0	30	0	2	
VI.	Shifnal (Haughton Hall) ...	4.30	+ .81	.77	19	16	...	...	...	...	...	...
VII.	Tenbury (Orleton)	3.70	+ 1.46	.59	9	17	65.0	5, 6	30.0	31	2	3	
VII.	Leicester (Town Museum) ...	4.26	+ 1.03	.70	9	22	71.2	5	30.5	31	1	4	
VII.	Boston	2.57	...	.40	24	20	71.9	5	31.2	27+	2	9
VII.	Grimsby (Killingholme).....	1.94	— .18	.52	24	18	70.0	5	29.0	30	2	...	
VIII.	Mansfield	2.16	...	.72	24	18	65.0	6	31.0	30	1	...
VIII.	Manchester (Ardwick).....	2.93	...	.63	24	20	76.8	5	30.0	30	4	4
IX.	York	3.93	+ .40	.66	25	16	61.0	3**	32.0	30	1	...	
IX.	Skipton (Arncliffe)	1.66	— .86	.45	21	15	70.0	7	29.0	30	1	4	
X.	North Shields	6.76	+ .10	1.06	25	23	68.0	6	28.0	29	3	...	
X.	Borrowdale (Seathwaite).....	1.50	— 1.78	.59	30	17	64.0	5, 7	29.3	30	1	1	
XI.	Cardiff (Crockherbtown).....	16.16	— .16	3.00	20	20	...	...	...	...	...	...
XI.	Haverfordwest	5.76	...	1.09	23	18	69.4	6	32.0	30	1	...	
XI.	Aberdovey	6.72	+ 1.53	1.15	21	18	66.5	5	31.5	31	1	2	
XII.	Llandudno	4.70	...	.87	23	20	74.0	5	32.0	30	1	...
XII.	Dumfries (Crichton Asylum)	3.62	— .34	.58	9	17	73.0	5	37.0	29	0	...	
XIV.	Hawick (Silverbut Hall).....	3.47	— 1.70	.99	22	19	66.5	5	29.5	30	2	2	
XIV.	Glasgow (Cessnock Park) ...	2.32	...	.55	21	15	...	...	...	...	...	...
XVI.	Mull (Quinish)	3.95	— .41	1.01	23	19	...	...	...	...	...	...
XVI.	Loch Leven	7.72	...	1.56	10	22	...	...	...	...	...	...
XVI.	Tyndrum (Ewick)	4.60	— .38	.90	22	12	...	...	...	...	...	...
XVII.	Arbroath .....	...	...	...	...	...	...	...	...	...	...	...
XVII.	Braemar	2.06	— 1.63	.51	21	11	65.0	3	33.0	2+	0	...	
XVIII.	Aberdeen	5.01	+ 2.26	1.55	30	18	63.8	6	26.0	2	5	15	
XVIII.	Gairloch	2.73	...	.49	30	20	64.5	3	33.4	30	0	8
XVIII.	Portree	7.05	...	1.06	31	19	...	...	...	...	...	...
XIX.	Inverness (Culloden)	10.39	— .39	1.19	20	24	...	...	...	...	...	...
XIX.	Dunrobin	2.11	— .55	.37	30	21	64.9	8	33.6	1	0	8	
XX.	Sandwick	3.05	— .18	.70	29	19	62.0	3, 6	32.0	28§	2	...	
XX.	Caherciveen Darrynane Abbey	4.87	— .05	.74	31	22	59.0	9	33.6	29	0	1	
XX.	Cork .....	...	...	...	...	...	...	...	...	...	...	...
XXI.	Waterford	3.49	...	1.25	7	16	...	...	...	...	...	...
XXI.	Killaloe	3.02	— 1.38	.88	7	13	66.0	5	34.0	12||	0	...	
XXII.	Portarlington	5.39	+ .37	.87	7	17	70.0	2, 3	32.0	31	1	...	
XXII.	Monkstown, Dublin	2.45	— 2.68	.53	7	25	65.0	5	32.0	29	1	...	
XXIII.	Galway	1.90	— 2.02	.77	7	14	...	...	...	...	...	...
XXIII.	Waringstown	3.40	...	1.04	20	21	65.0	4**	35.0	31	0	...	
XXIII.	Edenfel (Omagh)	3.47	...	.80	9	21	68.0	4, 5	28.0	31	2	5
XXIII.	Ballyshannon	4.91	...	.68	20	20	66.0	6	32.0	1¶	3	...
XXIII.	Ballyshannon	6.20	...	.80	31	19	...	...	...	...	...	...

* And 31. † And 30. ‡ And 30. § And 29. || And 30. ¶ And 30, 31. ** And 5, 6.
+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON OCTOBER.

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.—Month on the whole favourable for field and garden. Prevailing wind early in the month S. and W., then N. and E., and last ten days N.W.

CULFORD.—The weather up to the 29th was mild for the season, and tender plants in the flower garden continued in bloom up to that date. S fell on the morning of the 30th, yielding 12 in. Swallows and martins seen on the 11th. Mean temp. 50°; easterly winds prevailed during 13 days; high wind on 9th and 10th; T on 24th.

SPROWSTON.—First half of month very fine; from 21st to 28th stormy; sharp frosts on mornings of 30th and 31st; rainfall more than half an inch below the average.

SHIPNAL.—An unusually mild October. Fog on 2nd, 17th, 18th, and 20th. High wind from N.W. on 28th, and bitterly cold afterwards. Dahlias and other tender plants untouched by frost; red admiral and tortoiseshell butterflies out till 19th, on which day a large green dragonfly was seen hawking for flies as in summer.

ORLETON.—Temp. high, and weather generally fine during the first half of the month. After the 18th the weather became cold and cloudy, with R every day except one, and heavy falls on the 19th, 21st, and 23rd. The high hills were covered with S on the morning of the 29th, and there was a little on the lowland on the 30th. Mean temp. of the month about 0.75 above the average; bar. generally low and unsteady; L was seen on the nights of the 9th and 22nd, and the wind was frequently rough, especially on the 7th, 9th and 10th.

KILLINGHOLME.—Up to the 20th warm and fine, and R wanted on strong soils for growing wheat; the latter part of the month cold and wet; L on nights of 28th and 29th. [*Erratum* in last month's remarks:—for horse flies, read house flies.]

MANSFIELD.—The month was remarkable for a low barometer, the mercury having fallen to 29.06 and 29.02 on the 10th and 26th respectively. Mean of the month 29.740 in., 1.97 in. below the average 1872-78. T on 11th, 25th, and 28th.

YORK.—Several instances of spring flowers in blossom, specially of the primrose tribe. S on 24th, 29th and 30th.

SEATHWAITE.—Seven days on which the fall of R exceeded one inch. S on hill tops at end of month.

WALES.

HAVERFORDWEST.—More wind than usual during the month; two very stormy periods of long duration from the 4th to the 10th, and from the 19th to the end; weather between delightful, bright sunshine with unusual heat.

ABERDOVEY.—Unsettled weather till the 10th; fine, calm and clear up to the 18th; stormy and wet to the close, with N. and N.W. winds prevalent; T with H on 28th and 30th.

SCOTLAND.

HAWICK.—A very fine month; sharp frosts on the night of the 1st and 31st. Potato crop very plentiful and fine in quality; many garden annuals in full bloom at the end of the month.

QUINISH.—Very high temp. from 1st to 20th. Weather broken and stormy throughout the month, except from 13th to 20th; from 20th to end of month very cold.

BRAEMAR.—A fine month; hills covered with S for the first time this season on 22nd, an unusually late date.

PORTREE.—A very cold stormy month; a continuous gale on 28th and 29th from N. to N.W., with heavy S showers; T and L on 28th.

DUNROBIN.—Month on the whole seasonable. Vegetation better ripened this autumn than for many years.

SANDWICK.—Generally a pleasant month till 21st, mild and dry; but then the bar. fell and continued below 29 in. for 5 days, and R fell daily. During the last six days the wind was N. with cold weather; sleet showers and a gale of 55 miles an hour on the 30th. There has been no aurora this autumn, and distant L reported by a neighbour on 28th, but not seen at this house, is the only L noticed this year.

IRELAND.

KILLALOE.—After some heavy falls of R, the month closed with fine, dry, but cold weather, and N.W. wind.

WARINGSTOWN.—Rather wet, but the ten days fine weather in the middle of the month allowed the farmers to get out the potato crop in good condition.

EDENFEL.—With the exception of the third week, which was fine and clear, the month was cold, inclement, and stormy.

BALLYSHANNON.—The month was wet and severe throughout. "The Donegal Summer," which is generally expected here about this time, has not favoured us, and winter seems fairly to have set in. Many showers of H during the month, and the River Erne swollen to winter height.

THE WEATHER IN OCTOBER.

On the 30th September a sudden and brisk fall of the barometer occurred over these Islands, and a well-marked depression—which had apparently come in from the westward—lay over the north of England. This disturbance subsequently passed away eastward, the mercury rose, and high uniform readings, with light breezes, were reported until the evening of the 2nd. At this time the anticyclone retreated in a south-easterly direction to Scandinavia, but was quickly succeeded by others, which travelled from our S.W. coasts northwards to Scotland, making pressure very unsteady in the W. and N. From the 6th to the 12th the changes in pressure were large and important, but at the same time gradual and regular. On the 6th a uniform decrease of about 0·3 in. was shown over these Islands, but the disturbance which caused it passed outside our coasts, and only strong southerly winds or moderate gales were experienced. On the following day, however, the barometer fell very quickly in the S.W., a deep depression (28·8 in.) advanced to these coasts, and a hard southerly gale sprang up, extending to our other coasts, though with less force. On the 7th a brisk recovery took place, accompanied by south-westerly breezes, but the barometer again began to fall, the wind backed, and a strong gale was reported from Scilly. This fresh disturbance proved to be as serious as the one just noticed, and as it advanced slowly in a north-north-easterly direction, hard westerly to southerly gales were experienced on nearly all coasts. In the rear of this disturbance a brisk recovery took place, but gradients remained steep, and the winds strong, until the 12th, when a large anticyclone was shown over England and France, and light variable breezes prevailed. For the first day or two the weather was dull, with a good deal of rain in many places, and on the 10th dull, squally, and unsettled weather was reported from all Western Europe, with an inch and a half of rain at Ardrossan, and smaller amounts elsewhere.

During the next week (13th–19th) the distribution of pressure underwent little change. At first a large area of high pressure lay over the north of France, North Germany, and the S.E. of England, while low readings were reported from our western coasts. Throughout the week depressions moved from S. or S.W. to N. or N.E. over or near to our western coasts. On the 13th the temperature stood at about 55° over these Islands, and in the north of Sweden it was as high as 44°. On the same day the lowest minimum was reported from Nottingham and London, the readings being 37° and 35° respectively. The weather during this week was cloudy, but exceptionally dry.

For the remainder of the month the weather was for the most part exceedingly unsettled, and several depressions of considerable importance passed across Western Europe. The main depressions, which were large and deep, have passed over our northern coasts in an easterly or north-easterly direction towards Norway, but on the 22nd, 24th, and 26th, smaller and subsidiary disturbances travelled from W. to E. over Southern England.

On the 27th pressure had increased quickly over the whole of N.W. Europe, the change varying from nearly 0.6 in. over Ireland, to about 0.3 in. on our east coast, while in Denmark and the south of France the barometer fell slightly. This rapid and very general rise of the barometer was followed on the 28th by a rather sudden fall on our N. and N.E. coasts. A depression lay between the Shetlands and the south of Norway. This depression on the day following lay near the mouth of the Skager Rack, remaining there till the 31st, when it appeared to be filling up.

Temperature oscillated considerably during the last ten days of October, and was low for the time of year. Thunderstorms occurred at some places in England, mock suns were seen at Nottingham on the 30th, and a solar halo in London. Rain was frequent, and in some instances heavy, and snow fell on our eastern and southern coasts on the 31st.

H. E. M.

SEVERE SNOWSTORMS ON NOVEMBER 12TH.

The gales which have now been prevalent in some districts for several days, and the snowstorms, particularly in the North of England and in Scotland, seem to have been of exceptional severity, for so early a period of the winter.

Snow fell heavily in the morning of the 12th, in the Durham, North Yorkshire, Cleveland, and Westmoreland districts, to the extraordinary depth of fifteen or eighteen inches. There being a strong wind it was considerably drifted, rendering locomotion either by foot or vehicle difficult. The through Scotch express to London was greatly detained between Newcastle and Darlington, being more than four hours late.

An accident, resulting in the total destruction of a plate mill, took place at the ironworks at Consett. A terrific snow storm, accompanied by lightning had raged all night, and between five and six o'clock in the morning, when the storm was at its worst, the roof of No. 4 plate mill fell and buried the workmen. A portion of the roof fell on the furnaces and the hot iron. In a few minutes the fallen *debris* was in flames. The steam pipes were smashed, and the escaping steam added to the confusion. A considerable time elapsed before all the men were got out. Those most severely injured were carried on stretchers to the iron company's infirmary, where they were attended to by Dr. Renton, and other Surgeons.

The blinding snow storm at Braemar on Monday night, the 11th, gave place to keen frost, but the violence of the gale did not abate anything. Snow wreaths were packed as high as the fences in sheltered parts of the road, trees were blown down, stacks of timber levelled, palings broken, and much damage was caused by the fury of the gale. Shortly after ten a.m. on the 12th, the storm burst again with terrible severity, the gale, if possible, louder and stronger than before, but instead of snow, sleet accompanied it. The storm continued to rage till a late hour without any palpable variation in its fury.

Early on the 12th there was a heavy fall of snow in the West of England, and the fall was succeeded by a severe frost. About eight o'clock a policeman on duty at Bristol Bridge saw a market woman fall from her seat into her cart. He drove her to the infirmary, where life was found to be extinct. Deceased was a married woman, named Perry, who had started from Yatton, a dozen miles distant, early in the morning in good health, but died from exhaustion, consequent upon exposure to the severe cold.

THE CLIMATE OF HASTINGS.

On Tuesday evening, at the Wellington Square Lecture Hall, A. E. Murray, Esq., Fellow of the Meteorological Society, read a paper, " Local Meteorological Report for 1877," with remarks on cyclones, influence of the moon, &c. J. G. Thompson, Esq., president of the Philosophical and Historical Society, was in the chair, and there were also present Mr. T. H. Cole, M.A., Dr. Bagshawe, Mr. Colborne, Mr. Henry, Mr. W. Andrews, Mr. A. L. Ward, Mr. P. H. Cole, &c. The diagrams referred to in the lecture were thrown on a screen by oxy-hydrogen light. Murray's paper was as follows:

Mr. President, Ladies, and Gentlemen,—In continuation of my previous papers I have now the honour of presenting to you my Meteorological Report for the year ending December 31, 1877.

The instruments, hours of observation, and manner of exposure, remained the same as in the preceding year. From January 1, however, the maximum temperature in the sun was also observed by a black bulb thermometer *in vacuo*, placed four feet above the surface. The station was inspected on April 13 by R. H. Scott, Esq., Secretary of the Meteorological Office, and everything was found satisfactory. I think I may honestly say, as a guarantee for the correctness of the observations, that I believe everything possible has been done to insure their accuracy. Although I have before made the same remark, I would iterate and reiterate the opinion of everyone who has properly attended to the subject, that it is far better to abstain from observations altogether, than to take them with uncertified instruments, badly exposed, at varying hours.

Before commencing the report, however, I must say a few words on a personal matter. In March last I sent a letter to the local papers, saying, that, in consequence of the amount of writing and calculation the observations entailed, I felt compelled, most reluctantly, to give them up. It was long before I could arrive at this decision, but I acted on my own maxim, that observations are useless unless properly corrected and reduced to a manageable form; and to do this I had no longer the time. I offered to hand over all my instruments to anyone who would continue the work properly, simply requiring them to obtain certificates from the Meteorological Office at intervals, that the returns had been duly filled up. A week or so after this I unexpectedly received a letter from the Town Clerk, kindly offering me a certain sum yearly to continue the work. This offer I declined, explaining that it was only want of time that decided me to discontinue the work, but also added, that if the Council would remunerate someone to work out the calculations and fill up the forms for me, I would willingly continue the observations at 9 a.m. and 9 p.m., as heretofore; everything on my part, of course, being gratuitous. I am glad to say they have agreed to this proposal, and for the last few months Mr. D. Bennett, of Quarry Hill School, has very carefully and satisfactorily fulfilled the office of computer. I think it is greatly to the credit of the Town Council that they have thus come to the assistance of meteorology, and I am quite sure the town will gain by the act, for I know of no place where the observations prove more clearly the excellence of the climate.

Mon.	Mean Pressure.	Air Temperature.				Relative Humidity.				
		Means of Absolute.								
		9 a.m.	9 p.m.	Min	M'x					
Jan...	29.877	29.893	44.1	44.4	39.7	48.5	31.1	54.8	91.2	89.2
Feb...	29.941	29.980	43.5	42.9	39.1	48.2	24.0	54.0	88.8	85.5
Mar...	29.784	29.776	47.1	40.1	35.6	46.1	25.1	53.8	82.3	86.7
April...	29.774	29.773	47.4	45.1	44.3	51.6	35.1	58.5	79.9	86.3
May...	29.806	29.860	50.7	46.0	42.7	54.8	31.2	61.5	76.9	84.5
June...	30.033	29.037	62.2	57.7	52.7	67.6	44.9	76.5	72.6	81.6
July...	29.027	29.027	61.9	58.3	53.7	65.8	45.3	75.5	76.5	88.1
Aug...	29.002	29.011	62.6	60.0	55.3	67.6	46.4	75.7	79.6	86.3
Sept...	29.066	29.071	55.6	52.8	48.7	61.9	39.3	68.2	80.5	84.6
Oct...	29.062	29.050	51.9	50.4	44.6	57.9	32.9	63.3	82.7	83.5
Nov...	29.752	29.758	47.9	42.8	38.6	42.6	32.7	59.1	86.2	85.5
Dec...	29.061	29.081	40.7	40.9	36.9	46.0	28.0	51.5	90.3	90.1
M'ns	29.926	29.926	50.7	48.9	44.5	55.5	—	—	82.6	86.6

In the first place, I will bring to your notice a table containing the most important meteorological facts for the year; but, as there are a great many figures, I fear that you would be asleep before I came to the end of them. We will, therefore, if you approve, take them as read; but, in order to be able to grasp the most salient facts, a slide has been prepared showing them pictorially. The firm black lines represent the barometer, and the dotted lines the thermometer. The topmost line shows the highest reading of the barometer in each month; the next, the mean of all the observations; the third, the lowest reading. The highest rise was in December; the lowest fall and mean also, as is usually the case, in November. The thermometric lines show, in the same manner, the highest, lowest, and mean of 9 a.m. and 9 p.m. readings. The highest point reached was 76.5 in June; the lowest 24.0, in February. You will notice that the mean temperature in January, November, and December was higher at 9 p.m. than at 9 a.m.; and I find, from comparison, this is the rule, not the exception. In May, the temperature fell abnormally to 31.2. From the line at the lower part of the diagram, it will be seen that 7.04 inches of rain fell in January; the fall then remained steadily between two and three inches till August; after which it fell, and then rose again to 3.81 in October, and 7.39 inches in November, and fell again in December.

The next diagram shows the number of times wind was recorded from the different points of compass during the year. By far the greater portion of our winds is from points near south-west and north-east. We have very little indeed from anywhere between east and south. Perhaps from the appearance, from a meteorological point of view, is to a certain extent illusory, for, as a rule,

the wind remains only a short time in the same direction when it blows from points between east and south, and therefore the chances are that it would not be reported; for the diagram represents the wind at 9 a.m. and 9 p.m. only. This diagram although based on the number of times the wind was observed from each point, more truly represents the length of time it blew from the different quarters. In February no wind blew from any point between north-east and south-west.

Finally, for this part of the subject I have arranged the chief totals for 1875-6.7 under each other. It will be evident from this table how extraordinarily near the figures remain when each year is considered as a whole. Thus, the mean temperature for 1875, at 9 a.m., was 50.4; for 1876, 50.6; 1877, 50.7; a difference of only three-tenths of a degree. Most of the other figures differ from each other in like proportion. According to all the thermometers, there has been a slight increase in the mean temperature during the last three years. It will be interesting to note whether 1878 also has an increase. If so, perhaps it may be attributed to the great number of new houses which are constantly springing up around us; but my belief is that the increase of the rainfall during each of the past three years accounts for the increase of temperature, either both being the effect of the same cause, or the excess of rain being the cause of the increase of temperature. The rainfall for 1877 was about twelve inches above the average. It is curious to notice that the mean height of the barometer for the three years at 9 a.m. and 9 p.m. is exactly identical, even to the thousandth part of an inch. The averages of the three years are useful as giving a very near approach to the true means for the town, but I must warn you against accepting them as the exact means, for in all probability the addition of the next half-dozen years will alter all the figures slightly. The rain is certainly too high on account of the fall having been so unusually great during the past three years.

Having reviewed the year as a whole I propose to take now the months separately, with the remarkable phenomena. January the 1st will make a very good beginning, for the new year was ushered in by a very severe gale. I have had a weather chart photographed for that day, but before considering it I wish to state, as briefly as possible, the causes of changes of weather, so far as they are at present known. Perhaps I should rather say the secondary causes, for we are almost entirely ignorant of the primary ones. Probably most of my hearers are aware that there are two main divisions of atmospheric disturbances, cyclones and anticyclones, the former are also called "depressions." But, although these may be treated for the sake of simplicity as if they were separate phenomena, there is every reason to believe that they are closely connected with each other. The diagram now before you shows the chief characteristics of each. Cyclones, for practical purposes, but not when they are examined theoretically, may be compared to whirlwinds, with a tendency of the wind to blow towards the centre. Their forward motion in northern latitudes, with hardly an exception, is from westward to eastward and their internal motion or whirl is invariably in the opposite direction to that in which the hands of a clock move, namely from east round north to west and south. The front part, in winter especially, is warm with strong wind and heavy rain, the rear cold with often high wind for a short time and clearing weather. In summer, however, owing to the thickly overcast sky during the advance of a depression, the temperature is usually low. These whirlwinds, as mentioned before, advance from westward to eastward, and have two motions, first, their own internal motion, second, their onward movement. It is very important to bear this in mind, for the wind in the whirl itself may be blowing at a rate even of a hundred miles an hour, whereas the movement of the disturbance as a whole may be at the rate of twenty miles an hour, or even less. Thus immediately it reaches our west coast its arrival can be telegraphed to the east coast, and several hours, sometimes twenty-four, elapse before it has travelled across England. It would be quite impossible to do this if the wind blew in a direct line, not in a curve. If a depression passes directly across a place from west to east, the wind is first south with a falling barometer, then comes a calm during which the centre passes, then a rapid change to the north, with a rising barometer. On the diagram, below the sectional view, I have inserted figures showing how the barometer would be affected during the passage of a depression. If, before its arrival, it stood at 30 inches, it would probably rise to perhaps 30.1. Then it would fall to say 29.5, then rise again, and if a satellite were accompanying it, the barometer would again fall and rise very rapidly indeed when it had passed. If the centre passes to the north, as is usually the case with us, the wind is first south-west, and changes through

west to north-west. If the centre passes south, the wind is first south-east, and then changes through east to north-east. The depressions sometimes cross us diagonally, and then these directions are slightly changed.

Anticyclones to a great extent are cyclones reversed. They have a high barometer in the centre, are, as a rule, cold with little wind, which revolves in the contrary direction to that in a cyclone, the weather is often fine but overcast and foggy in winter, but clear and bright, with warm days, in the summer. They remain almost stationary for days together. The drawing of each will be useful for showing the difference between cyclones and anticyclones, but they will not bear theoretic scrutiny, for there are many things about cyclones very difficult to understand. These large depressions often have smaller ones as it were running round them. We, in the South of England, unfortunately are in the path of many of these satellites, and most of our severe storms have been caused by them. I have shown a satellite in the section. You will notice that if one follows a large depression it causes the outside of the main one to become deeper, but reduces the gradient, as it is called, of the inner side. It is a rule that the steeper the sides the stronger is the wind, therefore it depends on the relative position of a certain place with regard to a satellite whether it increases or reduces a gale.

A careful study of the features of a depression will show what are the premonitory signs of its arrival. The following I think the most important. The sky becomes gradually overcast, usually with a sheet of very thin cloud formed in the higher parts of the atmosphere. The clouding generally commences in the west, and the clouds at first often assume the appearance of "streamers," and the motion is usually from the westward, although the wind may be in some other quarter, frequently at this it will be backing towards south-east. These signs may take place before the fall of the barometer, which invariably follows, and is quick or slow according to the nature of the depression. The fall of the barometer is accompanied, especially in the winter, by a rise of the thermometer. The wind now increases and the rain begins to fall. Lunar and solar halos are also forewarnings, and likewise a short rapid rise of the barometer before the fall. Besides these signs I have also noticed that a heavy ground swell frequently precedes a gale. If all these signs are present a depression may almost with certainty be predicted. But my advice is, Do no prophesy publicly. I once, two or three years ago, ventured to put a remark at the end of my weekly weather report that fine weather was likely to take place. Within half a dozen hours of the remarks being in type we were visited by a tremendous gale and heavy rain. My friends did not let me hear the end of it for some time.

Now I think we are ready for the chart of January 1. On the evening of December 31 a large depression was passing across Great Britain. It was still visible on the morning of the 1st to the eastward of us, but by that time another had approached rapidly from the westward. Neither could well be called a satellite of the other, for apparently they were of about equal size, but the second by following so rapidly on the first acted in the same manner as a satellite would have done in deepening the gradient on the southern side of it. The steepest barometric gradients, as will be seen from the isobars being so close together, were over the North of France, the Channel, and the South of England, therefore we had a very heavy gale while there was almost a perfect calm in the centre of England. A great deal of damage was done here and at other places on the south coast during this gale. By next morning both depressions had passed to the eastward of us, and the barometer had risen nearly an inch. From the 1st a period of wet, unsettled weather set in which continued during the whole month. The rainfall was very unusual, being 7.035 inches, against 1.205 in 1876, and 4.010 in 1875. The total fall during December and January was 14.225 inches. The rain fell on twenty-five days, out of thirty-one, the exceptions being the 12, 15, 21, 22, 23, 26. 1.040 inch fell on the 8th, and 1.240 inch on the 10th, the latter being the greatest fall yet recorded in twenty-four hours. The temperature was very high indeed for the time of year, having risen to 54.8 during the storm of the 1st, against 51.3 the previous year. The mean temperature at 9 a.m. was 7.3 above the corresponding figures of 1876, while the mean temperature for the month by Glaisher's tables was 44.5, against 37.4 in 1876. The lowest temperature was 31.1, instead of 20.9 in 1876, and it was below 32 degrees on only two days. The mean of the barometer was very low, it having fallen to 28.820 on the 1st.

As a whole, the month of February was overcast and warm for the time of year, but during the night of the 27th the temperature fell to 24 degrees, and 19 on the grass. The air was also most unusually dry, the dew point being 7.6 at 9 p.m., and 13.4 at 9 a.m. next morning. It is rather curious that a total eclipse of the moon occurred on that night. The extraordinary state of the atmosphere would be considered by those who adopt the theory of lunar influence, as strong evidence in favour of it.

While on the subject, I might mention the result of some calculations I made to see whether the moon had any power to clear the sky or not. I must confess when I first began observations I leaned decidedly to the side of those who say it has, now however, I have gone over to the opposite. I found that my calculations on the following fact. If two thermometers are exposed, one close

to the ground not protected in any way, and another four feet above it, protected from radiation, on a cloudy night there will be very little difference between them, but on a clear night that on the ground will always read some degrees, even ten or fifteen lower than the other. By this fact I determined to prove, from instruments alone, whether there was less cloud at full moon than at any other quarter. For the year 1876 I picked out all the days of full moon, new moon, and first and last quarters, and found that the difference between the thermometers was in the following proportion: Full, 24·7; last quarter, 39·3; new, 41·0; first quarter, 46·6, showing that for that year there was most cloud at full moon, instead of least, and least at the first quarter. I then combined one day on each side, and obtained the following figures: Full, 91·9; last quarter, 108·0; first quarter, 116·3; new moon, 151·5; giving least at new moon, most with the following result, taking one day: First quarter, 38·9; new, 43·1; full, 49·9; last quarter, 52·5, giving most to the first quarter, least to last quarter. Including one day on each side: First quarter, 130·1; new moon, 137·5; last quarter, 150·1; full moon, 158·3, giving most to first quarter, least to full. I have given the results on the diagram to show plainly how utterly at variance the two years, both separately and combined are, but evidently a much longer period would be required to prove anything. My impression from the figures is that we should find that the different years, would in time neutralise each other, and that then it would be seen that the amount of cloud at all ages of the moon is the same, and that the idea of the moon clearing the sky is an optical delusion, arising from the fact that there is usually less cloud at night than during the day; but the gradual clearing is not so striking unless the moon is rising at the same time. I hope to add 1878 by-and-by.

The mean temperature of February was 43·6, against 40·4 in 1876 and 36·2 in 1875. The rainfall was about an inch above the average. Out of fifty-six wind observations, forty-nine had west in them. Not a single case of east-north-east, east, east-south-east, south-east, south-east, or south wind was recorded—a very unusual occurrence. A strong gale from the west and north-west took place on the 20th, heavy snow for an hour in the evening of the 22nd, and hail and graupel showers on the 26th and 27th.

March commenced fine, but cold, the temperature on the 1st falling to 25·1 and 18·7 on the grass, but in the evening it rapidly rose, and the next three days were warm, with drizzling rain. I have often noticed that a rise of temperature is preceded by a very cold night. This may be accounted for on the supposition that the warm current has already set in overhead, dispersing the clouds and causing great radiation to take place from the surface of the earth. The following week was much finer, but cold with showers of snow at times. The 11th was unusually fine. Then changeable but pretty fine weather set in, with heavy showers of graupel and rain at times. On the 23rd there was a good deal of snow fell. On the 24th a depression passed across Great Britain, causing heavy rain, but little wind, the barometer falling to 28·944 inches on the morning of the 25th. To the end of the month the weather was pretty fine but changeable. The mean temperature was 4 degrees lower than that of January. In fine, all the temperatures were lower than those for the two preceding months, the max. in the sun alone excepted. The wind was variable.

The month of April was fine for the time of year, with, of course, now and then showers of rain. There was nothing particular to remark with respect to the extremes and means. The chief phenomenon was a severe hail-storm on the 4th. I was in Newgate Wood at the time, and noticed a heavy, black cloud roll up rapidly from the southward, accompanied by heavy thunder, and I believe several persons saw lightning, but I did not. At 3·10 hail-stones of most unusual size, being about half an inch long and three-eighths of an inch broad, fell. They were chiefly conical, with alternate layers of clear and white ice, the point being white. Heavy showers of rain soon followed. Newgate Wood must have been near the western boundary of the storm. Its full force was felt chiefly in the eastern part of the town, where much damage was done, e. g., 200 panes of glass were broken at Gilbert's Nursery. He described the stones as like small walnuts, or the bowl of a pipe. Many windows were broken at Halton Parsonage and other places. The storm passed over Ore, but reached neither Hollington nor St. Leonards. This storm was apparently caused by the passage of a small depression, and it can be traced from one end of England to the other. It reached Durham between half-past seven and eight. During April there were three other storms, but all distant. Eight solar halos were observed.

May commenced cold and dry, with high barometer, and north-east wind, but upper currents chiefly westerly. Pressure gradually diminished, and on the 7th the weather became very much warmer, and remained moderately so to the end of the month. On the 17th, a depression passed over us, when half an inch of rain fell. This was succeeded by an overcast period, with rather heavy rain on the 19th and 21st. It then continued chiefly fine till the 27th, when a severe gale blew, the wind continuing strong during the two following days. The means were much as usual, except that, as a whole, the temperature was rather low. The mean temperature was 48·1, against 47·4 in

1876, and 52·7 in 1875. The number of rainy days was above the average, the total fall of rain below it.

June was undoubtedly fine and warm, rain falling only on eight days. On the 1st there was a heavy gale, after which the weather became fine and continued so to the end of the month, except it was rather unsettled for a few days about the 20th. On the 4th there was a short but severe thunderstorm in the evening. The day had been hot and fine, with wind changeable from east to south, the clouds chiefly cirrus of various kinds from south-west. In the morning two or three claps of thunder were heard. At 8 p. m. heavy clouds came up from between south and south-west, accompanied by a great deal of brilliant lightning. About 8·40 two very heavy, dense, white masses of cloud, tapering at each end, passed quickly overhead, the first being the larger of the two. They appeared to be rapidly revolving. The first vanished almost in a moment, the second nearly as fast. By nine o'clock the storm, which now consisted of almost constant thunder and lightning, came up, and exactly at nine, or perhaps two minutes before, a very heavy shower took place. At this time the lightning was almost overhead, the flashes being almost entirely horizontal. Before the storm the barometer rose, after it, it fell. The temperature remained stationary.

On Monday the 11th the most severe storm that has occurred at Hastings for a very long time took place. It lasted at least from six p. m. till one a. m. of the 12th. The characteristic features were the changing of the wind, the rises and falls of the barometer, the immense length of the flashes, which were chiefly horizontal, and the comparative lightness of the thunder. About three a. m. a carriage was found on fire at the station, said to have been struck by lightning, but I could neither discover the place where it had been struck nor any melted metal. Also at three a. m. the storm had almost, if not quite, expended itself. The rainfall during the continuance of the storm was 1·71 inch. The barometer remained chiefly steady and high during the month. The mean temperature rose 10 degrees above that of May, and was 3 degrees higher than last year.

There were no striking features during July. The means both barometrical and thermometrical were rather low, and the rainfall high, rain falling on fourteen days. A rather severe thunderstorm occurred on the afternoon of the 7th, and sea fog at times on the 30th. It was rather unusual that neither at nine a. m. nor at nine p. m. did wind blow from north-north-east to south-south-east, except once from south-east. August was not so settled as usual, although at times the weather was everything that could be desired. The means as a whole were low, and the weather changeable, the barometer and thermometer fluctuating considerably. On seventeen days rain fell, but not in large quantities, the greatest amount being 0·64 inch on the 25th. The temperature did not rise so high as during 1876 by 11 degs.—75 against 86. From the 26th to 28th, the wind was very strong. Thunder and lightning occurred several times, but no serious storm. [Mem.—From the 8th to the end of the month observations were taken by deputy.]

September was the reverse of August, the weather, especially towards the end of the month, being fine and bright. The barometer was high and steady, but the temperature low for the time of year. The wind was chiefly from north to east. Only 1·07 inch of rain fell, there being only nine rainy days, and on them the rain was chiefly in showers. [Mem.—From the 1st to the 5th, observations were taken by deputy.]

From the 1st to the 20th October was fine, especially towards the commencement, but two or three moderate gales occurred, and a severe one began on the evening of the 14th and continued during the next day. In this gale the “Cleopatra” was abandoned in the Bay of Biscay. From the 20th, the weather remained unsettled till the end of the month, a series of depressions passing across England causing at times severe gales, especially on the 30th. Rain fell every day from the 21st to 30th, except on the 28th.

November was unsettled from beginning to end, numerous depressions, some very deep, passing across us. Rain fell on twenty-four days out of the thirty, and the amount was 7·390, being greater than any month since observations were begun in July, 1874. The mean of the barometer was lower than it had been during the year. The temperatures were high, the lowest being 32·7, whereas in 1876 it fell below 32 degs. three times. The mean temperature was 48 degs., against 45 last year. Specially severe gales occurred on the 11th, when the estimated force was 10, and on the 24th, when a small depression passed to the south of us and force 9 to 10 was registered, and it probably blew harder during the night. The rain-fall on that day was 1·325 inches. Thunder and lightning occurred several times during the month.

Considering the time of year, December was fine, especially after the first week. From the 8th to the 24th rain fell only on seven days, and then but in small quantities. The total fall was 2·7 inches, against 7·190 in 1876. On five days only did the temperature fall below 32 degs. The mean temperature was rather high, but nevertheless 7 degs. lower than that of November. No gale of particular note occurred. The wind reached force 7° on the 12th and 14th. No striking phenomena took place.

I have now finished my own report, and will pass on to the rain returns for the neighbourhood. The following have kindly forwarded me copies of their returns:

HASTINGS.
Mr. W. Andrews, Borough Surveyor ... 39 18
Copy of return from Harmer's Reservoir,
Mr. J. Banks, Bleak House..... 36 29
Mr. E. Field, Hastings Cemetery 39 75
Mr. C. Murray, The Firs, Ore 39 85
Mr. A. H. Wood, The Hollies 41 66
Mr. W. B. Young, The Grove, Hollington 41 72
My own gauge received 39 11

WINCHELSEA.
Miss Styleman 39 64
Mr. T. Budden 39 49
Monthly totals have also been kindly sent by—
Captain W. R. Lewis, The High Beech, Hollington ... 38 55
Mr. M. Vidler, C.E., Pevensey 38 94

The mean fall for the Hastings District, omitting one return, which I believe to be incorrect, owing to the bad exposure of the gauge, is 39·78. The average rainfall for Hastings, according to calculations made for the British Association, is 27·01, so that we had 12·77 above our proper amount. This fact I think those answerable for our water supply should keep continually in mind, for as we have had during the last few years so much over our average, undoubtedly before long we shall have as much below it.

The diagram now on the scene gives the fall at each station for each month.

On four days during the year—viz., the 8th and 10th of January, 11th June, and 24th November—the fall exceeded an inch; while on three other days—viz., Oct. 24, Oct. 27, and Nov. 29—it exceeded the same amount at some stations. The greatest fall of all was 2·40, collected by Mr. Young at Hollington on June 11, during the severe storm. On that day the amounts differed considerably at the different stations.

I have also received monthly, from C. Murray, Esq., of the Firs, Ore, a very carefully-kept Meteorological Journal, for which I return many thanks. This has been of great use for comparison; also much valuable meteorological information from G. W. M. Thompson, Esq.

I must likewise return thanks to the donors of the following books and pamphlets, which I shall be happy to lend to any member of the society:—R. H. Scott, Esq., Secretary of the Meteorological Office—the Daily Weather Charts.

Observations from stations of the Second Order, Part II., 1875.

Ditto, Part I., 1876.

Quarterly Weather Report, 1874, Parts III. and IV.

Supplement to the Report of the Permanent Committee of the 1st International Congress.

Report of the Meteorological Committee for 1876.

Signor Guido, Pesaro, Sicily—Meteorological Returns, August and September, 1876, January to August, 1877.

Dr. H. Hildebrand Hildebrandsson, Upsala, Sweden—Bulletin Météorologique, June to December, 1876.

Atlas des Mouvements Supérieurs de l'Atmosphère.

E. G. Aldridge, Esq.—Torquay Directory of September 5 and 12, containing Letters on Climate.

R. Tennent, Esq., Edinburgh—Why the Barometer does not indicate Real Vertical Pressure.

On Barometrical Depressions.

Extract from Journal of Edinburgh Royal Society, being Letter Addressed to Mr. Stevenson.

F. H. Parsons, M.D.—Highlands of Hastings and St. Leonards as a Health Resort.

W. C. Punnett, Esq., Tonbridge Meteorological Report, 1876.

General Meyer, Chief Signal Officer, United States—Report of Chief Signal Office, War Department, U.S., 1876.

G. J. Symons, Esq.—Abstract of Observations made at Royal Botanical Gardens, 1871-6.

At last, to the satisfaction, perhaps, of some of my hearers, I have come to the end of my paper. There is one thing I should, however, like still to mention. Some months ago there was a very interesting discussion at the Meteorological Society on the climate of certain health resorts. By the way, I might mention that Hastings came out very satisfactorily. In the course of the discussion a gentleman remarked that my observations did not represent the climate of Warrior Square. Of course they do not fully. We, on a hill, undoubtedly have the advantage in summer over those who live along the front, and even all the year round I consider a hill the more healthy of the two. For very delicate persons, however, the front would be better during the cold months. I would advise some of our summer visitors to try the surrounding hills instead of the town, although even there they are far cooler, as I have before shown, than in many neighbouring towns. But I am wandering from my subject. I should be very glad if three or four ladies or gentlemen, the more, however, the better, in different parts of the town would take observations with thermometers that have been certified at Kew Observatory. They would only cost about 15s., and one would be enough, the fixing of which would cost about 3s. Placed outside a northern window and read as often as possible, night and morning at nine o'clock, it would yield very valuable comparative results, and would entail hardly any trouble. I do not say that it would be the best position possible, but as I keep two thermometers outside a similar window, besides my proper instruments, they could all be compared together. I shall be most happy to give any advice in my power on the subject, and believe it would not be labour in vain.

S Y M O N S ' S

MONTHLY

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DECEMBER, 1878.

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INDIAN METEOROLOGY.*

At last we have really high class meteorological work from India. By high class we mean that for which we are always pleading, namely, work involving original research; and, curiously enough, almost equally good work comes simultaneously from Calcutta and from Bombay. India, or at any rate the observatories of Bombay and Madras, have contributed largely to meteorological literature. We have 14 large quarto volumes of Bombay Observations, and yet our set is not perfect; and although the observations at Madras have not been printed in equal detail, yet the publications of that Observatory are as much as one can lift. And, after all, what have that pile of volumes taught the world? They tell us what was the pressure, temperature, and humidity of the air at Bombay at every hour of every day from 1845 to 1857; so far well, but what the public require is not only the original observations, but also the results. We have no hesitation in saying that the single volume recently published by Mr. Chambers is of far more general utility than the whole previously issued. It is so good that it can afford to be put before the meteorologists of all nations as a specimen of complete reduction; it is so good that the Astronomer Royal has had an abstract of it prepared which will be read at the next meeting of the Meteorological Society, and it is so good that we can scarcely suggest any improvements. We

**Indian Meteorologists' Vade-Mecum.* Parts I. & II.

Instructions to Meteorological Observers in India. By H. F. BLANDFORD. 8vo. Calcutta, 1876-1877.

Tables for the reduction of Meteorological Observations in India. 1876.

Report on the Meteorology of India in 1875. Calcutta.

Ditto ditto ditto 1876-1878.

Report on the Vizagapatam and Backergunge Cyclone of October, 1876. By J. ELLIOTT. Folio. Calcutta, 1877.

Report on the administration of the Meteorological Department of the Government of India. By H. F. BLANDFORD. 1875-6.

Ditto ditto ditto 1876-7.

Indian Meteorological Memoirs. Vol. I., Part I. 1876.

Ditto ditto Vol. I., Part II. 1878.

The Meteorology of the Bombay Presidency. By C. CHAMBERS, F.R.S. 4to, and Atlas of Plates. Bombay, 1878.

recommend the work to the careful study of those responsible for meteorological progress, as the best specimen we have yet seen of thoughtful reduction of a long series of observations. It may be well to append a few of the leading elements for Colába Observatory, 1847-1872 :—

Temperature	Latitude	18° 53' 45" N.	Bar. at 32°	{	Absolute max.	30·164 in.
	Longitude.....	72° 48' 12" E.			Mean	29·808 in.
	Altitude	37 feet.			Absolute min.	29·183 in.
	Absolute max.	100°·2.	Wind	{	Total rainfall	70·30 in.
	Mean daily max. ...	85°·2.			Max in 24 hours ...	15·31 in.
	Mean	79°·8.			Rainy days, 102.	
	Mean daily min. ...	73°·5.			Mean direction N. 71° W.	
	Absolute min.	53°·3.			Mean force 6·5 miles per hour.	

We now come to the collection of works issued under the direction of Mr. H. F. Blandford, the chief of the Indian Service—or, as he is officially called, Meteorological Reporter to the Government of India. And here we had better insert a few words of history—or at any rate refer our readers to an article entitled “Indian Meteorology in Parliament,” which appeared in the number of this magazine for May, 1874, to which we need only add that very shortly afterwards it was announced that an Indian Meteorological Office had been organized, with Mr. Blandford as chief. Looking at the quality and quantity of the work issued from that office, we have no hesitation in saying that no better appointment could have been made. The qualifications requisite in the head of a large meteorological department are by no means confined to meteorological ability. They include fixity of purpose, faculty of command (this is totally opposed to petty tyranny, which is a great defect), conversance with the instruments, methods and objects of meteorology, with the kindred sciences of physical geography, geology and botany, with the principal modern languages, and with something more than elementary mathematics. We cannot pretend to analyse the mass of material which Mr. Blandford has put before us—some 1,500 folio pages—but we have found in it proofs of his qualifications in every one of the above points. And besides that we find evidence of that somewhat rare quality—sound common sense—in not attempting more than is thoroughly practicable, in laying a good foundation for future work by the rigorous examination of the instruments and methods now in use, by keeping up imperfect observations and comparing them with perfect ones (instead of abruptly stopping the bad ones and so creating a hiatus which would remain for all time to come), and many other equally thoughtful arrangements which we need not detail. If anyone enquires whereupon we base these strong remarks, we refer them to the three 8vo. publications, “Instructions to Meteorological Observers in India,” “Meteorology of India,” and “Tables for the reduction of Meteorological Observations in India.” Before passing to the other works on our list, we may quote Mr. Blandford’s remarks upon—

“THE RAINFALL OF CHERRA PUNJI.—The highest precipitation occurs when a saturated current of air at a high temperature is met by a hill range

running athwart its course ; and the steeper the slope, the greater is the local precipitation. Cherra Punji, in the Khasi hills, long renowned as having the greatest recorded rainfall in the world, is a remarkable illustration of the combination of these favouring conditions. The Khasi hills rise abruptly from the *jhils* of Silhet, which being but a few feet above sea level, and receiving the copious drainage of the hills that surround Cachar and Silhet, present, during the rainy season, a broad sheet of water, from which emerge a few villages built on mounds, and the low ridges locally termed *tilas*. Over this low inundated tract, sweeps the south-west monsoon from the Bay of Bengal, and, meeting the Khasi hills, is abruptly driven up to a height of 4,000 feet, before it resumes its course towards Upper Assam and the Eastern Himálaya. These circumstances alone suffice to produce an exceptionally heavy rainfall along the face of the range. But Cherra Punji is, in some respects, exceptional, even in this highly humid region. It stands on a little plateau of thickly-bedded sandstones, bounded on two sides by precipices of 2,000 feet sheer descent, which close in gorges, debouching southwards on the plains. The south-west wind blows up these, as well as on the southern face of the general scarp ; and having reached the heads of the gorges, ascends vertically. Thus Cherra Punji is surrounded, or nearly so, by vertically ascending currents of saturated air, the dynamic cooling of which is the cause of the enormous precipitation which has made this place famous. It is almost certain that the annual average varies greatly in different parts of the station ; although the whole plateau does not cover much more than a couple of square miles. Some of the earlier registers, which were kept at sites near the edges of the plateau, shew a higher precipitation than those kept in recent years at houses nearer its centre."

Two principal publications have been commenced by Mr. Blandford—one occasional, the other annual. The occasional one is entitled "Indian Meteorological Memoirs," being occasional discussions and compilations of meteorological data relating to India and the neighbouring countries. The best notion of the nature of this work will be given by quoting the titles of the papers :—

- I. The winds of Calcutta.
- II. The Meteorology and Climate of Yarkand and Kashgar.
- III. The Diurnal Variation of the Barometer at Simla.
- IV. Storms in Bengal in 1876, with increased atmospheric pressure.
- V. The rainfall of Benares in relation to the prevailing winds.
- VI. The Diurnal Variation of the Barometer at Calcutta and Hazaribagh.

All the works we have hitherto noticed have borne such evidence of originality of thought and treatment, and at the same time of uniformity, that we are forced to the conclusion that a very large proportion of the work has been done by Mr. Blandford himself. How he can have got through it we cannot tell, for we know of no one with whose it can be compared. But besides all this there are the massive Reports on the Meteorology of India for 1875 and 1876, of which the letterpress is indisputably Mr. Blandford's writing ; and even if he has a hundred assistants it is none the less an enigma how he has contrived to supervise and unify such a tremendous "output" of mental work. These last works are thoroughly worthy of the Indian Government, and may with confidence be put in comparison with those of every nation—but we think that at last we have found two points in which improvement is possible. Mr. Blandford admits the remarkable nature

of the fall of rain at Cherra Punji, he gives returns from 274 stations, why does he not re-establish one at Cherra Punji? Secondly, may we suggest that what with changes in the mode of spelling Indian names, and what with the smallness of some of the stations quoted, it is not easy to identify the locality of his minor stations. We should like to see a map of the stations in the next volume, but if not, that at least the latitude, longitude, and approximate altitude of *every* station be given.

We have one more work to mention, viz., that by the late Mr. Elliott, on the Vizagapatam and Backergunge Cyclones of 1876, a memoir which Mr. Blandford says is "entitled to rank as perhaps the most complete monograph of a cyclone that has ever been put on record," a verdict in which we thoroughly concur. The opening chapter of it gives so good a *résumé* of the progress of cyclonology that, especially as the original work is not easily obtainable, we adopt the unusual course of reprinting *in extenso* the following article:—

CYCLONE THEORIES.

A brief recapitulation of the various theories which have been advanced to account for the phenomena and origin of cyclones will be useful, not merely for reference in the discussion of the recent cyclones, but also as showing the present practical and theoretical knowledge on the subject of cyclones. The observations hereafter given in detail will be employed partly to test the various theories.

The earliest writer of importance on the subject of cyclones was Mr. Redfield. Colonel Capper, in his observations on the wind and monsoons published in 1801, had stated his belief that the storms of the Indian Ocean were whirlwinds or rotatory storms. He stopped short at this anticipation, stating that "it would perhaps not be a matter of great difficulty to ascertain the position of a ship in a whirlwind by observing the strength and changes of the wind. If the changes are sudden and the wind violent, in all probability the ship must be near the vortex of the whirlwind; whereas if the wind blows a great length of time from the same point; and the changes are gradual, it may be reasonably supposed the ship is far from the vortex."

Mr. Redfield contributed a series of papers, dating from the year 1822, to American scientific journals, in which he developed the theory that they were vast progressive whirlwinds or rotating storms moving along curved paths. About the same time Professor Dove in Europe had come to the conclusion that all the phenomena of such storms are fully explicable by the assumption of one or more rotary atmospheric currents or whirlwinds advancing slowly in a definite direction.

The circular theory was also adopted by the next important writer on this subject, Lieutenant-Colonel Reid, of the Royal Engineers, in his work on the Laws of Storms. He not merely confirmed the results of the investigations of Mr. Redfield, but laid down, from examination of the tracks of a number of storms, the important generalization that in the rotary storms of the tropical regions of the northern hemisphere, the direction of rotation of the winds is N. W. S. E., or opposite to the direction of motion of the hands of a watch with its face upwards; whereas in the storms of the tropical regions of the southern hemisphere, the direction of rotation is the opposite—N. E. S. W. He was thus enabled to give a series of rules for the guidance of sailors navigating tropical seas.

Mr. Piddington took up a similar line of inquiry, and analyzed carefully the path of every storm in the Bay of Bengal and Indian Ocean of which he could obtain any records. He fully adopted the circular rotatory theory, and suggested the use of the word cyclone for all such storms. He gave an elaborate

series of rules for the information and guidance of sailors navigating these seas.

But, as Mr. Buchan observes in his hand-book on meteorology, it should always be remembered that in the charts given by Reid, Piddington, and others who adopt in its simplicity the circular theory, the arrows representing the wind direction are drawn always tangential to circles described about the centre of the area of calm solely on the assumption of the truth of the circular theory. They are hypothetical directions serving in their works a definite purpose, that of enabling them to lay down practical rules for sailors navigating seas visited by cyclones, and are undoubtedly a rough approximation to the actual character of the atmospheric motion during cyclones, which is what Sir John Herschel terms vorticeous or spiral in its nature. Numerous synchronous storm charts, giving the absolute direction of the winds at the same instant, have been drawn by various meteorologists, and show that there is an indraught of air to the central region of calm as well as a rotatory motion. The combination of the two motions gives a spiral or incurving motion of the air towards the centre.

The upholders of the circular theory had thus seized only a part of the truth. The other element, the indraught or centripetal part of the motion, an important element, was left out of consideration. Mr. Espy, of Philadelphia, adopted this element to the exclusion of the other, laying down what is known as the centripetal theory. From personal observation of the direction in which the trees were lying on the ground after the tornado of the 19th of June in New Brunswick, he came to the conclusion that in this storm the winds must all have been blowing and converging to a centre. He afterwards adopted the theory of the converging motion of the air in the case of all cyclones to a centre caused by a rapid upward vertical motion at this centre, due to the vast amount of heat given out by the condensation of vapour and the subsequent fall of rain. He also laid down as a general rule that whenever a fall of rain is going on over a large area, there is necessarily produced an upward motion of the strata in and above which condensation is going on, which is followed by an indraught from all directions in the lower atmospheric strata and an out-draught in the higher.

Dr. Dove meanwhile was devoting great attention to the subject of the meteorology of winds and storms. He elaborated the idea which underlay the explanation given by Hadley to account for the easting of the trades wind, and established what he termed the law of gyration. This is that, in consequence of the diminishing velocity of rotation at places of the earth's surface as we proceed from the Equator to the Poles, "in the Northern Hemisphere, when polar and equatorial winds succeed each other, the winds veer in the direction S. W. N. E. S., and in the Southern Hemisphere, when polar and equatorial currents succeed each other, in the direction of S. E. N. to S. He also explained, on theoretical principles, the opposite directions of rotation of cyclones in the Northern and Southern Hemispheres. He also showed that the cyclonic movement of the wind was in all cases in accordance with the general principle underlying the law of gyration, and that it might be due to a mechanical obstruction, as a range of hills, or the resistance of another mass of air, or that it might result from the struggle of opposite currents which alternately displaced each other. The former is apparently his more matured explanation. The next theory of importance, that of Professor Taylor, adopted by Sir John Herschel in his work on Meteorology, is a modification of Espy's Centripetal Theory and Dove's Law of Gyration. Cyclones owe their origin, according to this theory, to the action of local heat producing an upward expansion and vertical motion of the air over a limited area. This is followed by an indraught from all the neighbouring districts, which would be strictly in accordance with the centripetal theory, if the earth had no motion of rotation. The rotation causes these winds to be deflected in approaching the centre, and the result is an inner spiral motion round a centre, over which a continuous ascensional movement of the air is going on.

The latest authorities on the subject of cyclones in the Indian Ocean and Bay of Bengal are Messrs. Meldrum, Blandford, and Willson. Mr. Meldrum, who has made a lengthened study of the cyclones of the Indian Ocean, and has traced out a connection between solar spot frequency and cyclone prevalence, frequency, maintains that in the Southern Indian Ocean they are primarily due to the action of lateral parallel opposite currents of winds. In the intermediate belt between the opposite winds the mass of air is in a state of comparative calm, and in consequence of the friction on opposite sides, it gradually acquires a rotatory motion. In this theory the rotatory motion and the barometric depression at and near the centre primarily result from the action of the parallel and opposite winds. Mr. Willson maintained the same theory. His opinion, as given briefly in the report on the Meteorology of Bengal for 1874, is as follows:—"I have elsewhere stated that in the cases which I had been enabled to examine it appeared highly probable that cyclones in the Bay of Bengal, like those in the Southern Indian Ocean, were generated between parallel wind currents blowing in opposite directions, and that the determining causes were probably not local, but far removed from the place of the storm's origin; that in fact the unusual vigour of the opposing winds which precedes the generation of such storms is probably produced in the first instance by abnormally high pressure some 10 or 15 days beforehand on both sides of, but far removed from, the belt which afterwards becomes the battle ground of the opposite currents. In the case of the cyclone under report (the cyclone of 3rd to 5th May, 1874) no doubt whatever can be entertained of the previous existence of the opposite winds, and it is equally certain that about eight days beforehand the pressures to the eastward, and to the westward especially, were very much above the average for the season."

The full explanation of his views and their extension to the October cyclones of the Bay of Bengal is given by Mr. Willson in his report on the Midnapore cyclone. The following extract will suffice to show its nature:—

"It appears to me that the theory of opposite currents, perhaps slightly modified in accordance with local circumstances, would account for the formation of this cyclone, as well as the local depression theory. The winds were N. E. over all the Bay north of latitude 17° , and W. S. W. south of latitude 15° . It seems therefore not improbable that long before the N. E. surface wind commences to blow with any strength, there is an upper N. E. current from the region of high pressure to the region of relatively low pressure. This current is drier, colder, and heavier than the opposing damp W. S. W. current, which must therefore be forced upwards along the belt where the winds collide and where the N. E. current descends. The W. S. W. current appears to be always the more powerful of the two. This fact is explained in the present instance by the high pressure at Nancowry compared with the pressure over Bengal. However, it would seem probable that a very gentle N. E. current, or even a calm dense atmosphere would be sufficient to check and force upwards the powerful but less dense W. S. W. monsoon, thereby producing the enormous precipitation of moisture which is always observed near the place of the origin of a cyclone, and which probably plays a very important part in its formation. As the precipitation of moisture continues, the atmospheric pressure diminishes along the head of the W. S. W. monsoon. The north-easterly current hence becomes more vigorous, and gradually extends northwards as a strong surface-wind. Ultimately the N. E. current becomes sufficiently powerful to generate the cyclone. The above is a short sketch of how it appears to me the theory of opposite currents may be applied to account for the formation of the cyclones of the Bay of Bengal."

Mr. Blandford's theory is given briefly in an appendix to his paper on "The Winds of Northern India." It is what has been termed the local depression theory. A calm state of the atmosphere, or one in which the winds are light and variable over the open sea, is the first condition favourable to the production of cyclones. The second condition is a high or moderately high temperature. The consequence of this combination of conditions will be the production

and ascent of a large quantity of vapour, which will be condensed with the liberation of its latent heat over the area of its production, instead of its being carried away to some distant origin. If this state of things last for some days, the atmospheric pressure will be locally lowered, causing, or tending to cause, an indraught of air towards the place of minimum pressure. One further condition appears to be essential. The actual formation is finally determined by the inrush of a saturated stormy current from the S. W. or W. S. W.

METEOROLOGY AT THE PARIS EXHIBITION.

Continued from Page 152.

SECOND only to Redier among the continental exhibitors were Hottinger et Cie, of Zurich, who have succeeded to the business of J. Goldschmid, who exhibited such marvellously sensitive aneroids at the South Kensington Loan Exhibition. Their case was crowded with instruments. We will begin with Dr. Koppe's **per cent. hygrometer**, which may be shortly described as a Saussure's hygrometer,* with an arrangement for adjusting the index to the true reading. A long paper in which this instrument is engraved and described appeared in the *Zeitschrift* for February 15th, 1878, under the title "On the estimation of humidity by means of Psychrometers and Hair Hygrometers, and on a very judicious combination of the two instruments." We recommend both the instrument and the paper to any one interested in the anomalous results afforded by Dry and Wet Bulb Thermometers at temperatures near 32°, and at very low temperatures also. We pass on to **aneroid barometers**, for which the firm has always been celebrated. They are all on the Goldschmid or Weilenmann system, that is to say, without any chains, and with micrometer contact pieces something after the style of those proposed to be made by Mr. Loseby, of Leicester. The delicacy of their reading is simply marvellous; one of them, 3 inches in diameter and 2½ inches high, is guaranteed to read to 0·005 mm. or to 0·0002 of an inch! If the atmospheric pressure would but remain steady, such an instrument would almost beat a measuring tape. Of course such precision is not attained without some trouble, but it is not excessive; there is no doubt that in giving the vacuum box scarcely any work to do, the true principle of a good aneroid is adopted; and lastly, no one can say that £6 is too high a price. We cannot praise their **self-recording aneroid**; it may be the best of its class—we do not say that it is not—but now that it is possible at a moderate cost to get a *continuous* trace showing all the delicate oscillations of atmospheric pressure, we cannot recommend an instrument which only records the pressure at one instant during each hour. The **self-recording hygrometer** exhibited by this firm seemed to us a cheap and useful instrument, although probably many Englishmen will think otherwise when we state that the thermometer was a metallic one, and the humidity was obtained from a hair. Everybody cannot buy a Kew thermograph at £120, but many a small establishment might be able to spare £16, and by carefully adjusting to the readings of standard instruments we believe very useful results might be obtained: one special recommenda-

* See Met. Mag., vol. II., pp. 66.

tion is that neither light, nor photography is required. The firm also exhibited a **self-recording rain gauge**, which we hope to describe fully on another occasion.

Tonnélet, of Paris, exhibited a very good series of **Fortin barometers** of the pattern chiefly used in England. Alvergnyat showed a **barometer** with all three arrangements for correcting for the variation of the level of the mercury in the cistern, viz., a fixed ivory point, an ivory point attached to the scale and moveable with it, and a plunger of the same diameter as the tube.

There were a great many exhibitors of **ordinary aneroids**, but none call for special notice. Arronit had an **aneroid** of a pattern resembling one which we first saw used in Clum's Aëloscope, viz., with one dial for the ordinary scale of millimetres and another for the tenths of a millimetre. In Clum's instrument the hand travelled once round the dial for each barometric inch, and the inch was shown by a separate scale near the centre. Eon showed a **rain gauge** in which the depth of rain was to be read through a glass plate; it would fail utterly in frosty weather; perhaps it was only intended for summer or in-door use. Aléy showed the most tasteful series of **ornamental thermometers** we have ever seen. The **high-class thermometers** of Baudin appeared very good, but without testing them it is rather a farce to express an opinion.

We may mention here the *full equipment of meteorological instruments*, for the Normal Schools of which a set was exhibited.

Thermometer Stand, Montsouris pattern (see *Met. Mag.* vol. xiii. page 49).

Barometer, Fortin's pattern, made by Salleron.

Maximum Thermometer, Negretti's pattern, made by Baudin.

Minimum " Rutherford's " " "

Dry Bulb " " "

Wet Bulb " " "

Hair Hygrometer, by Salleron.

Piche's Vaporimeter, by Salleron.

Solar Radiation Black Bulb in vacuo, by Salleron.

" " **Clear** " " "

Ozonoscope.

Hervé-Mangon's **electrically recording anemometer** was exhibited in several places, most of them being made by Hardy.

Theorell's **meteorograph** was also there. The distinguishing feature of his instrument is that instead of giving a continuous pencil or photographic curve, which for purposes of calculation must be converted by the observers into numerical values, this meteorograph prints the values on a strip of paper. The merits and demerits of this arrangement are very evenly balanced. It is a great advantage to be saved the trouble of tabulating the values from the curves, but it is a great disadvantage not to know what occurs in the intervals which occur between successive printings by the instrument, even if they occur each 15 minutes. For instance, the indication of the inclination of a cyclone axis which can be deduced from the difference between

the time of passage of a barometric minimum, and that of the change of the wind's direction and force at the earth's surface, could not be ascertained by this instrument.

It is hopeless to try to report upon the Maps, Charts, Books, Photographs, and Diagrams exhibited, they were so numerous. We can only specify a few.

Prof. A. R. Harlachier sent on behalf of the *Service Hydrométrique de la Bohème* a very fine series of diagrams of the regime of the Elbe and the Moldau. Prof. Raulin sent a map of **the rainfall of the whole of France**, showing total fall, but tinted chiefly to show seasonal distribution. M. Hébert had forwarded on behalf of the Commission Météorologique de la Haute Vienne, an elaborate report upon **the Storms of 1876**, with excellent MS. charts. The Comte Sansac de Touchimbert, of Poitiers, sent a photograph of his **thermometer stand**, respecting which we can hardly do better than transcribe our original note, "just like a *tall mushroom* !"

RAINFALL STATIONS.

I FIND considerable difficulty in sufficiently impressing my correspondents with the importance of at once reporting the death or removal of neighbouring observers, and the commencement of new sets of observations. The three essential qualifications of a good rainfall organization are accuracy, continuity, and equality of the geographical distribution of stations. As regards the last two my correspondents could help very greatly if, whenever they hear of any change of residence, &c., among their neighbouring observers, they would send a post card to report it—even if the same event were reported by two or three, no harm would be done. This request applies especially to the County Superintendents, to whom one naturally looks for such help.

I have been led to these remarks by having just completed the annual examination of the entire list of observers, because I feel that in spite of the great care we take to render our list as perfect as possible, some of the observers are probably dead, others removed, and others prevented from continuing their records. Judging from past experience, these cases are not one per cent., but still they might be reduced almost to infinity, and therefore I invite the assistance above indicated.

It appears, now that all the stations are plotted on the map (no light matter with about 2,000 stations), that there are still some rather large districts in which no observations are being made. The following are some of the principal, and any assistance in obtaining observations from them will be most acceptable.

Districts and Towns from the neighbourhood of which Returns of Rainfall are much required.

ENGLAND.

Ashbourne, Derbyshire
Castle Cary, Somerset
Chagford, Devon
Dorchester, Dorset
Folkingham, Lincoln

Goathland, York, N.R.
Kirkby Moorside, York, N.R.
Kirtton, Lincolnshire
Newmarket, Cambridge
Whitchurch, Hants

WALES.

Builth, Brecon
 New Radnor, Radnor
 Tregaron, Cardigan

Llanfyllin, Montgomery
 Llanrwst, Denbigh

SCOTLAND.

Huntly, Aberdeen
 Kilmordan, Argyll

Loch Rannoch, Perth
 Spital, Perth

Also in the S.E. of Ayrshire, along the Caledonian Canal, and in most parts of Ross and Sutherland.

IRELAND.

Bailyborough, Cavan
 Bangor, Mayo
 Connemara, Galway

Dunmanway, Cork
 Kanturk, Cork

It will be remembered that there is now no grant or fund whence rain gauges can be supplied gratis; but accurate instruments verified can be obtained from 15s. upwards.

G. J. SYMONS.

62, Camden Square, N. W.

ESTIMATION OF OZONE.

ALTHOUGH the enquiry upon this subject in our last number was addressed to the Editor, we thought that by leaving it unanswered, some replies might be elicited. Not one having come to hand, we wrote to Dr. Fox, who replies as follows:—

“The answer to the question is simply this, that ozone is now estimated—by those who are tired of the old inaccurate and worthless method—in one of three ways.

1. By means of test papers made with the purest iodide of potassium *without starch*, over which a known amount of air is passed by the help of aspirators.
2. By means of Houzeau's test papers, which alone register ozone to the exclusion of the other air purifiers, namely, peroxide of hydrogen and nitrous acid.
3. By quantitative chemical analysis. Known and measured quantities of air are passed through a solution of an arsenite, which is oxidized, and becomes converted into an arsenate. The amount that undergoes or does not undergo this change is measured.”

It now seems desirable to follow up the subject by ascertaining where observations are made by these several methods, specifying which or whether more than one method is adopted at each station.

We find that in the last Quarterly Return of the Registrar General the amount of ozone is reported by the observers at—

Guernsey,	Oxford,	Kelstern,	Silloth,
Helston,	Gloucester,	Eccles,	Carlisle.
Torquay,	Somerleyton,	Hull,	
Strathfield Turgiss,	Nottingham,	Cockermouth,	

It will tend to put our knowledge on a better footing if each of these observers will kindly send word what method he adopts. We have also seen recent reports on the amount of ozone at the Royal Observatory, Greenwich; it will be interesting to know the method adopted at that establishment.

THE WEATHER IN NOVEMBER.

DURING the first week of November the changes in barometric pressure over Western Europe were both considerable and important. Readings were generally highest to the westward of Ireland, while a large depression was shown over Scandinavia. Besides this main depression, subsidiary disturbances passed south-eastwards over or near these Islands. At first they were comparatively slight, and the northerly wind which prevailed generally was not very strong, except in the east. On the evening of the 7th the mercury fell briskly in the N.W. with a south-westerly wind, and a deep depression passed south-eastwards over England, causing fresh to strong northerly gales in its rear on all but our northern coasts. As this disturbance passed away over Germany, the barometer rose extremely rapidly, but during the 9th a fall of half-an-inch took place in the N.W. ; a deep depression advanced to these coasts and fresh south-westerly gales sprang up. During the following day (10th) gales and heavy rains were general. On the 11th the disturbance was moving away over Norway, the barometer was rising, and strong northerly winds prevailed ; but in the evening of the same day and the morning following the barometer was falling again, and three depressions were shown. One of these was in the N., a second in the N.E., and a third in the S.W. Northerly winds still continued, and increased to a hard gale in the N. and S.W. during the 12th. On the 13th a broad band of low readings stretched across France and the North Sea to Norway, within which four distinct minima were observable. In the evening pressure recovered again, and the depression in the S.E. was apparently filling up. The next morning, however, the disturbance was deepening again, and on the 14th steep gradients prevailed over western Europe, and severe northerly to north-easterly gales were again experienced on our coasts. On the 16th the depression still lay over the Baltic in the neighbourhood of Holland, the wind circulating round it as on the previous day, though with less force. The mercury was falling nearly everywhere.

The weather during the third week was very much quieter than that of its predecessors. A cyclone which lay over the southern portion of the North Sea on the 17th occasioned rather fresh northerly winds on our coasts, and southerly winds in Denmark, subsequently filled up and moved away southward, the wind gradually became N.E., and an area of high pressure was formed over these Islands. On the 19th, a well-marked anticyclone stretched from Ireland across England and the North Sea to Denmark, and this general distribution, though occasionally slightly modified, lasted till the close of the week. The temperature was low over England, though comparatively high over Scotland.

For the rest of the month N. and N.E. winds were the most prevalent, and the latter blew a fresh gale all along our east coasts during the night of the 27th and all through the 28th, accompanied by a good deal of cold rain. On the 29th a change occurred ; a depression travelling in a southerly direction passed down our western coasts during the day, causing some rather fresh W. to N.W. winds in those regions with rainy weather, while N. airs and fine weather were experienced in the E. Aurora borealis and lightning were seen in Caithness on the night of the 29th.

The first half of the month was characterised by considerable atmospheric disturbances, with general falls of rain, hail, and snow, and in the second week thunderstorms in some places. The third week was the quietest, the weather, though cloudy and very foggy, being dry. The last week of the month was cold generally ; very dull, foggy, and wet in the S.E. and E., but much finer in the W. and N., especially in the earlier part of the week. Temperature was low for the greater part of the month, and oscillated considerably. Frosts were also experienced on many nights.

H. E. M.

HEAVY SNOW-FALL.

To the Editor of the Meteorological Magazine.

SIR,—On the night of the 11th there was a fall of snow which is generally acknowledged to have been heavier than any remembered to have ever fallen in so short a time, and which I had supposed to be an impossible fall. It drifted to some extent, but its average depth was $10\frac{1}{2}$ inches. My rain-gauge (1 foot above the ground) registered 0·673 in., which was evidently much below the true value ; so at 1 p.m. on the 12th I inverted the funnel on the snow, where it appeared to be the average depth ; but it was too deep to take up all at once, so I first took up the upper part, and then the remainder. I found that the $10\frac{1}{2}$ inches when melted yielded 1·626 in. of water, of which 1·033 in. was yielded by the upper 4·9 in. of snow. I was so surprised at the result—the proportion of water to snow being so much larger than usual—that I made an approximate measurement on the 13th, at 10.30 p.m., near the same spot, when the depth of snow was reduced to 7 in. ; it then yielded 1·55 in. And on the 14th, at 1.30 p.m., the snow being reduced to 5·8 in. deep, it yielded 1·528 in., of which 0·784 in. was from the upper 2·2 in. It had been a thaw nearly all the time since the snow fell, and 0·01 in. of rain fell between the first two measurements.

It seems that it would be no exaggeration to set down the snow-fall at 1·63 in. of water, of which 1·60 in. belongs to the 11th. I intend to have an iron cylinder made, the same diameter as the funnel, so as to be prepared if such a snow-fall should ever occur again.

The ratio of water to snow (including the rain) is shown in the following table :—

Measured.	Depth of snow.	Ratio of water to snow.		
		Upper part.	Lower part.	Whole.
Nov. 12th, 1 p.m.	in. 10·5	in. ·211	in. ·106	in. ·155
„ 13th, 10.30 p.m. ...	7·0			·220
„ 14th, 1.30 p.m. ...	5·8	·356	·207	·263

Much damage was done to spouts, shrubs, &c., by the weight of the snow. There was a thunderstorm during the snow-fall, with most dazzling lightning, nearest at 5.15 a.m. On the 15th we had a great storm from the N.N.E. I do not know whether the rain ever ceased from 7 p.m. on the 14th to the middle of the night of the 15th, but 1·51 in. fell.

It is very likely that this month will prove the wettest recorded for the last 19 years ; it will be so if more than 0·3 in. falls in the 10 days yet remaining, 5·47 in. having fallen already.—Yours truly,

T. W. BACKHOUSE.

Sunderland, Nov. 24th, 1878.

PERIODIC COLD?

To the Editor of the Meteorological Magazine.

SIR,—Is there any truth in the theory that exceptionally cold weather recurs every 41 years? I believe the only two authenticated instances in which the thermometer fell below zero in London were December 25th, 1796, and January 20th, 1838, just 41 years apart. As it is now 41 years since the latter date, to prove the truth of the above theory we ought to have very severe weather during the coming winter.—Yours truly,

W. P. SWAINSON.

277, Camden Road, London, N., Dec. 12th, 1878.

SUPPLEMENTARY TABLE OF RAINFALL IN NOV., 1878.

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

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	4.80	XI.	Castle Malgwyn ...	6.08
„	Littlehampton	2.84	„	Nantgwilt, Rhayader ...	5.61
„	Hailsham	4.66	„	Carno	4.61
„	St. Lawrence, I. of W....	4.21	„	Rhug, Corwen .....	...
„	Strathfield Turgiss	3.58	„	Port Madoc	5.19
III.	Addington Manor.....	2.99	XII.	Carsphairn .....	...
„	Oxford	2.24	„	Melrose	4.87
„	Northampton	2.73	XV.	Gruinart	2.87
„	Cambridge.....	4.63	XVI.	Grandtully .....	...
IV.	Sheering	5.07	XVII.	Tomintoul.....	7.14
„	Diss	5.65	„	Keith	8.20
„	Swaffham	6.60	XVIII.	Dalwhinnie	6.67
V.	Alderbury, Salisbury ...	2.17	„	Auchnasheen	3.48
„	Compton Bassett	3.15	„	Springfield, Tain	2.37
„	Dartmoor	6.25	„	Glenfinnan	4.91
„	Langtree, Torrington ...	6.35	XIX.	Watten	3.16
„	Cosgarne, St. Austell ...	6.61	XX.	Glenville, Fermoy ...	2.51
„	Taunton.....	4.66	„	Tralee	3.81
VI.	Bristol	3.22	„	Tipperary	2.32
„	Sansaw	5.89	„	Newcastle W., Limerick	3.14
„	Cheadle	2.37	„	Kilrush	2.55
„	Bickenhill Vicarage.....	3.02	XXI.	Kilkenny	1.38
VII.	Coston, Melton Mowbray	4.01	„	Kilsallaghan	1.39
„	Bucknall	3.97	„	Twyford, Athlone	1.29
VIII.	Walton, Liverpool	2.06	„	Belvedere, Mullingar ..	...
„	Broughton-in-Furness ..	2.78	XXII.	Ballinasloe.....	1.78
IX.	Stanley, Wakefield	2.13	„	Kylemore	5.41
„	Mickley, Ripon	4.42	„	Carriack on Shannon.....	1.37
X.	Gainford .....	...	XXIII.	Rockcorry	1.31
„	Unthank Hall	3.53	„	Warrenpoint.....	1.40
„	Shap	3.34	„	Newtownards ...	2.01
XI.	Llanfrechfa	5.06	„	Bushmills	3.45
„	Solva	5.65	„	Buncrana	5.36

NOVEMBER, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Dpth		Max.		Min.			
				inches.	in.			Deg.	Date.	Deg.	Date.		
I.	Camden Town	2.95	+	.54	.51	15	17	53.5	25	29.4	30	6	15
II.	Maidstone (Hunton Court)...	3.78	+	.75	.45	15	17	...	...	...	...	...	...
III.	Selborne (The Wakes).....	3.62	+	.08	.73	9	18	54.0	10	29.5	12§	13	19
III.	Hitchen	3.85	+	1.71	.89	27	20	48.0	10*	27.0	29	16	...
IV.	Banbury	3.63	+	1.43	.59	24	17	50.5	10	27.0	29	18	...
IV.	Bury St. Edmunds (Culford)...	5.16	+	2.77	1.10	15	22	52.0	25	20.0	29	14	23
V.	Norwich (Sprowston)	7.54	...	...	1.31	15	23	...	...	...	...	...	...
V.	Bridport	2.63	—	.53	.39	9	15	...	...	...	...	...	...
"	Barnstaple	4.64	+	.50	.99	9	17	53.0	25	31.0	3†	...	...
"	Bodmin	5.47	+	.49	.62	9	24	53.0	10	29.0	20	10	14
VI.	Cirencester	3.41	+	.62	.85	15	14	...	...	...	...	...	...
"	Shifnal (Haughton Hall)	3.60	+	2.03	.77	10	13	47.0	9	24.0	27	20	26
"	Tenbury (Orleton)	3.21	+	.74	1.10	9	14	50.3	3	27.0	27	14	16
VII.	Leicester (Town Museum) ...	3.25	...	...	.56	24	19	49.4	1	23.5	21	9	23
"	Boston	4.31	+	2.17	.91	14	18	48.0	1†	25.0	30	13	...
"	Grimsby (Killingholme)	4.92	...	...	1.11	15	21	49.0	1	27.0	12	9	...
"	Mansfield	2.43	...	...	.51	9	15	47.6	2	24.9	21	17	19
VIII.	Manchester (Ardwick).....	2.04	—	.59	.64	9	11	49.0	10	28.0	27§	13	...
IX.	York	4.24	+	2.26	.81	11	16	49.5	20	25.0	12	17	...
"	Skipton (Arncliffe)	5.69	—	.76	1.25	7	19	46.0	18	24.0	25	10	...
X.	North Shields	6.40	+	3.76	1.33	26	26	48.0	18	26.0	12	6	8
"	Borrowdale (Seathwaite)	5.82	—	10.85	2.50	9	11	...	...	...	...	...	...
XI.	Cardiff (Crockherbtown)	3.06	...	...	.84	9	13	52.0	10	27.8	23	6	...
"	Haverfordwest	6.72	+	1.05	1.50	9	18	49.0	4	24.0	25	13	24
"	Aberdovey	3.08	...	...	1.35	9	17	56.0	1	30.0	27**	5	...
"	Llandudno	3.32	+	.16	.82	9	16	52.2	10	30.8	26	1	...
XII.	Dumfries (Crichton Asylum) .....	...	...	...	...	...	...	...	...	...	...	...	...
"	Hawick (Silverbut Hall)	4.15	...	...	.71	16	18	...	...	...	...	...	...
XIV.	Glasgow (Cessnock Park) ...	1.73	—	1.02	.53	9	11	...	...	...	...	...	...
XVI.	Mull (Quinish)	4.97	...	...	1.34	9	18	49.0	26	...	...	...	...
"	Loch Leven	1.70	—	1.95	.60	26	...	...	...	...	...	...	...
"	Tyndrum (Ewick) .....	...	...	...	...	...	...	...	...	...	...	...	...
"	Arbroath	2.26	—	.63	.48	24	14	48.0	20	27.0	29	4	...
XVII.	Braemar	4.58	+	1.76	.55	16	19	44.8	10	20.0	9	15	26
"	Aberdeen	3.87	...	...	.55	24	26	49.2	21	27.8	29	6	22
XVIII.	Gairloch	6.60	...	...	.81	13	25	...	...	...	...	...	...
"	Portree	9.01	—	1.47	1.23	16	27	...	...	...	...	...	...
"	Inverness (Culloden)	2.94	+	.35	.95	25	18	49.4	20	25.2	28	9	21
XIX.	Dunrobin	5.30	+	2.99	1.47	12	19	50.2	21	25.0	27	15	...
"	Sandwick	3.61	—	.39	.52	9	26	50.2	20	27.0	24	4	17
XX.	Caherciveen Darrynane Abbey	3.19	...	...	.62	9	14	...	...	...	...	...	...
"	Cork	2.86	...	...	.85	10	10	...	...	...	...	...	...
"	Waterford	1.85	—	2.10	.84	9	18	52.0	3, 10	27.0	9, 26	15	...
"	Killaloe	2.59	—	2.30	1.32	9	10	55.0	2	19.0	26	15	...
XXI.	Portarlinton	1.65	—	2.27	.53	9	16	51.0	9	23.0	11	25	...
"	Monkstown, Dublin .....	.96	—	1.93	.47	9	9	...	...	19.0	25	...	...
XXII.	Galway	2.04	...	...	1.05	9	14	54.0	10	25.0	26	11	...
XXIII.	Waringstown	1.84	...	...	.33	11	21	51.0	4, 7	21.0	11	20	27
"	Edenfel (Omagh)	2.91	...	...	.47	9	21	48.0	1†	20.0	25	18	...
"	Ballyshannon	4.67	...	...	1.47	14	11	...	...	...	...	...	...

* And 24, 25. † And 2, 10. ‡ And 2, 9. § And 29. || And 30. ¶ And 20, 21. ** And 29.

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

METEOROLOGICAL NOTES ON NOVEMBER.

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.—A very foggy, damp, ungenial month; very little S, and not lying. Prevailing wind N.W.

BANBURY.—Thunder on 8th. A good deal of high wind.

CULFORD.—A month of excessive rainfall, and consequent disastrous floods. Exceedingly cold, damp, sunless weather, with some S, but less fog than usual. High wind on the 8th and two following days, and again on the 27th. Mean temp. 38°·6.

SPROWSTON.—The wettest month known in Norfolk. The rain, which fell every day in the first fortnight, culminated in a fall of 1·31 in. on the 15th, flooding the lower parts of Norwich, and doing damage to mills and cottages, amounting to thousands of pounds. The marshes along the Norwich and Yarmouth line are covered with water, and will be for some weeks. Wheat sowing has been much hindered, and it is impossible to work heavy land. Rainfall 1½ in. above the fall in November, 1875, which, till this year, was unparalleled.

SHIFNAL.—An unusually unpleasant November. Fog, R, S, and frost alternating throughout after the first six days, which were clear and frosty. The max. temp. never reached 48°, and although it was frosty on twenty nights, it was not severe enough to form ice half an inch thick. Wind, with a few exceptions, persistently from N. and N.W. Fieldfares first seen on 3rd.

ORLETON.—The temp. of the month was rather more than 3° below the average, but it was generally even, and the fluctuations of the bar. were slow and not great. S on 12th and 24th; very heavy R night on 9th–10th, flooding the brooks and rivers. The sky was generally cloudy, and the wind was frequently very rough. No T or L.

BOSTON.—The heavy rainfall in the middle of the month, together with a fall of snow caused the floods to rise very rapidly in the river Witham, and some of the protecting banks giving way, a considerable tract of fenland near Lincoln was submerged. The continued wet has seriously interfered with the completion of the wheat sowing, and much that was sown has been destroyed. An unusual amount of fog during this month, and the weather very cold and damp.

GRIMSBY.—The month was cold and wet; gale late at night on 9th, continuing till daybreak of 10th; 3 in. of snow at night on 11th.

YORK.—Month remarkably cold; 11 in. of snow on 12th; far heavier in the direction of Thirsk and Malton, but none at Scarborough.

ARNcliffe.—A very wintry month. Severe snowstorm on 11th.

NORTH SHIELDS.—Thunderstorm on 11th. Aurora on 5th.

WALES.

HAVERFORDWEST.—The weather during the first 16 days fearfully wild. Stormy throughout, with uniformly low temp. L on 2nd, 9th, 10th, 13th, and 27th. Precellly Hflls covered with S several days during the month; furious gales of frequent occurrence. Slight shock of earthquake about 0.45 p.m. on 10th. Very frosty and wintry from the 18th to the 27th. Altogether one of the most wintry Novembers for the last 29 years. Wind from N.N.W. the first third, and from N.N.E. and E. the last two-thirds of the month.

ABERDOVEY.—A fine calm clear month. Prevailing wind N. No S except on one night; very little frost.

LLANDUDNO.—The month on the whole was cold, sunless, and stormy, but there were a few very fine days. Though there were only three nights of frost, the mean temp. was 3°·5 below the average, and no less than 5°·8 below November, 1877.

SCOTLAND.

SILVERBUT HALL.—On the whole a very mild November. Very squally on the 15th and 16th. Heavy snowfalls on 8th, 9th and 26th.

QUINISH.—The month was unusually fine, the wind being almost invariably from N. and E. On some days near the end of the month the sun was actually very hot. Scarcely any S, and very little frost.

BRAEMAR.—Severe storm of S and drift on 11th.

ABERDEEN.—A month of dull, cold, raw, damp weather. Mean temp. $38^{\circ}\cdot 8$, $1^{\circ}\cdot 4$ below the average; rainfall about the average; L on 5th, H on seven days.

PORTREE.—On the whole a cold unsettled month. Solar halo on 3rd; heavy gale on 15th and 19th; S on 5 days.

DUNROBIN.—Weather on the whole favourable for outdoor operations, which are consequently far advanced for the season.

SANDWICK.—November was colder than the mean, owing to the prevalence of N. winds, which began on the 24th of October and blew on 23 days in Nov. Ground sprinkled with S on the 7th and 8th, and a good deal of frost from the 23rd to the end. No heavy fall of S as in some places further south.

IRELAND.

DARRYNANE.—A fine frosty month, with almost constant E. and N.E. wind; S on 11th.

CORK.—S in. of S on 11th.

WATERFORD.—Month colder than usual. Mist frequent about 20th.

KILLALOE.—Cold, but very fine; a good deal of sharp frost, particularly on 26th, with thick fog. Mean temp. much below average. Some S on 27th.

MONKSTOWN.—The coldest and (with the exception of November, 1867) the driest November for many years. A remarkable prevalence of northerly winds and unusually severe frost, which occurred without intermission from 12th to 27th.

WARINGSTOWN.—A very remarkable month; frost almost continuous, but the ther. never fell very low.

EDENFEL, OMAGH.—The severest November for many years; northerly wind prevailed almost the entire month, accompanied till the 20th chiefly by R and sleet, and towards the end by hard frost.

BALLYSHANNON.—The month was severe and wintry, and the temperature unusually low; on the 12th the ther. registered 12° . H on 7th, S on 11th, and 12th. Hoar frost from 24th to 28th.

DENSE FOGS.

To the Editor of the Meteorological Magazine.

SIR,—We have had here two or three days of unusually dense fogs, and now the ponds and ditches are covered with a greyish scum. This would seem to infer that the fog was not composed entirely of watery particles.

The wind had been in the north for a week or ten days previously. Is it possible that we have experienced some of the effects of an eruption of Heckla, or some other Icelandic volcano?

Perhaps some of your other subscribers may have noticed something of the kind.—Yours truly,

SAMUEL KING.

Elswick Lodge, November 23rd, 1878.

[In all such cases a portion of the material should be collected and analyzed. We think the origin is more probably nearer home—perhaps the furnaces at Barrow, about 20 miles N.W. Have any such effects been simultaneously noticed in the Orkneys, or on Loch Tay or Loch Katrine?—ED.]

RAINFALL AT ST. LAWRENCE RECTORY, ISLE OF WIGHT.

Latitude 50° 35' 6" N. Longitude 1° 14' 24" W.
 Diameter of guage, 5 inches. Height above ground, 1 foot. Height above sea level, 75 feet.
 Years 1868-77 inclusive.

Year.		JAN.	FEB.	MAR.	APRIL	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	Total Inches
1868	Inches.	4.00	1.08	1.27	3.14	1.30	0.54	0.68	4.36	2.56	3.72	1.37	7.31	31.33
1869	"	3.46	2.58	2.60	1.11	4.72	2.15	1.17	0.98	4.19	2.27	2.00	3.71	30.94
1870	"	1.83	2.20	1.79	0.33	1.23	0.25	1.60	1.24	1.59	4.59	2.28	3.06	21.99
1871	"	3.18	1.35	0.96	3.53	0.06	3.02	4.14	1.46	5.70	2.09	0.47	1.17	26.13
1872	"	5.84	2.06	3.60	1.31	2.76	1.88	3.23	1.09	1.70	5.15	5.31	6.02	39.95
1873	"	4.24	3.04	2.35	0.72	0.89	2.15	1.84	1.57	2.38	5.03	2.99	0.85	28.05
1874	"	2.14	1.35	0.76	2.34	0.62	2.26	0.56	1.45	3.63	4.64	3.17	2.68	25.59
1875	"	5.06	2.83	0.77	1.44	0.93	2.04	3.15	1.57	1.95	5.61	5.63	0.97	31.95
1876	"	0.73	3.54	3.82	1.69	0.27	0.88	0.93	4.66	4.39	1.75	4.43	8.21	35.30
1877	"	7.35	1.90	2.48	2.56	2.20	0.76	2.19	2.47	1.57	2.78	9.13	2.04	37.43
Average of 10 years each month.	Inches.	3.78	2.19	2.04	1.81	1.49	1.49	1.94	2.08	2.96	3.76	3.67	3.60	30.86
Rainfall for the year, 1878.		1.90	2.18	2.26	2.78	2.77	0.80	3.54	5.72	2.08	3.42	4.21	1.93	33.59

St. Lawrence Rectory, Isle of Wight, Jan. 1st, 1879. C. MALDEN.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLVI.]

JANUARY, 1879.

[PRICE FOURPENCE
or 5s. per ann. post free.]

ATLANTIC WEATHER.*

THE lapse of five years is rather apt to damp the interest in a storm, no matter how remarkable it may be, nor how excellently it may be discussed. That, however, is almost the only fault which we have to find with the present publication, which is a worthy companion to Capt. Toynbee's previous works.

We have read the preface with great pleasure, and re-produce part of it, because we wish to induce the Council to follow up their own convictions to their legitimate conclusion.

“The Meteorological Council have authorised the present publication as a remainder of the work of their predecessors. *It cannot be doubted that more work of the same nature as that here submitted would throw light on the atmospherical conditions which influence and determine the weather in the West of Europe.*”

Exactly so. We heartily agree with this, and we should like to know why we are not to have “more work of the same nature.” Everybody who knows anything of meteorology agrees that nearly all the weather changes of Western Europe come from the Atlantic. Le Verrier began to issue daily weather maps of the Atlantic and Western Europe in his *Atlas des mouvements généraux de l'Atmosphère* for 1864, but that broke down for want of adequate support; Hoffmeyer began his series of *Cartes synoptiques journalières* September 1st, 1873, but he gives no letter-press, and even of the charts we have received none of a later date than August, 1875; at the Vienna conference Brig. General Myers submitted his proposal for synchronous observations over the whole northern hemisphere, and the United States Government have printed masses of figures, but no maps and no discussion of the data; lastly, we have reason to believe that in

* *The Meteorology of the North Atlantic during August, 1873.* By Captain HENRY TOYNBEE. (Prepared under the authority of the late Meteorological Committee.) 4to, and atlas of plates. Stanford, 1878.

connection with their system of weather warnings to Europe, the meteorological staff of the *New York Herald* have very considerable stores of information.

Are questions of priority, of personal or national feeling, to prevent our doing that which is evidently both the wisest, the cheapest, and the most useful to all the nations of Western Europe, viz., concentrating every scrap of information in *one* office, charting it and thoroughly discussing it.

Of course, endless difficulties may be conjured up—some we have just glanced at, and plenty more may be imagined—cost, international jealousies, &c. Surely, when the proper course is clear, such questions ought to be swept away. Take the question of cost: the Meteorological Committee and Council have spent about £40,000* over their seven observatories. Which is more likely to help us to a knowledge of British weather, the continued maintenance of those observatories which have been at work for ten years, but from which we have seen woefully few *results*, or such a set of Atlantic charts as £40,000 would procure? Besides, it is not England alone which would benefit by this work, but the whole of Western Europe. Would the other nations leave us to bear all the cost, or would our Parliament object to voting the cost even of an ironclad in payment for a decisive effort to ascertain the laws of Atlantic weather?

And as to international jealousy—happily it is becoming a matter of history rather than of time present, and the *Bulletin Météorologique du Nord* is standing evidence that three European governments can bring out a joint publication; and if Norway, Sweden and Denmark can work together, why should not other countries?

The great importance of the question started by the preface has diverted our attention from the work itself, which is, we think, the best which Captain Toynbee has issued.

Years ago,† we asked, “Why have we not a daily weather map of the British Isles?” In less than twelve months the Meteorological Committee issued their first, and now they are not only published by them but also by nearly a dozen newspapers, so that tens of thousands of copies are published daily.

Now, relying upon the *ipsissima verba* of the Meteorological Council, we ask for daily records of Atlantic weather, because “it cannot be doubted that more work of the same nature as that here submitted would throw light on the atmospherical conditions which influence and determine the weather in the West of Europe.”

* We believe that this is below rather than above the truth; but the published accounts are now so complicated by the purchase and sale of instruments for third parties that it is impossible to ascertain what the observatories really cost.

† *Met. Mag.*, July, 1871.

THE FROST.

It was our intention to have given a table of the daily temperatures during the long frost which has characterized the close of 1878 and the beginning of 1879, but its distinguishing feature has been *persistency* rather than *intensity*, and the extremes would be so much less remarkable than those given in Vol. II. of this Magazine, that we have abandoned the intention. We, however, in support of the above remarks, give the minima for January, 1867, and for December, 1878, from the same stations, and in many cases from the same instruments:—

	Camden Square.	Selborne.	Hitchin.	Banbury.	Culford.	Orleton.	Arncliffe.	N. Shields.	Haverfordwest.	Culloden.	Waterford.	Portarlington.	Monkstown.	Galway.	Waringstown.
1867...	6·7	—2·0	9·0	12·0	0·0	1·6	8·0	14·0	8·0	14·6	16·0	8·0	12·0	15·0	2·0
1878...	18·7	11·0	15·0	8·0	10·0	7·7	9·0	9·0	9·0	13·8	14·5	8·0	11·0	11·0	5·0
1867..	12·0	13·0	6·0	...	10·0	6·1	1·0	...	1·0	...	...	...	...	...	3·0
1878...	...	...	...	4·0	...	...	...	5·0	...	0·8	1·5	...	1·0	4·0	...

The bottom lines show the number of degrees by which the intensity of cold was greatest in the respective years. From this it will at once be seen that in England generally, it was much colder in 1867, but that in Ireland the reverse was the case.

To the Editor of the Meteorological Magazine.

SIR,—The frost of the past month being remarkably severe for this place, I send you the following table, and some notes about it and the weather for the past month:—

Month.	Air Temperature.		At 9 p.m.		On grass.
	9 a.m.	9 p.m.	Max.	Min.	
1878.					
Dec. 8	33°·9	33°·9	38°·9	29°·1	20°·2
" 9	30°·0	31°·1	39°·9	26°·8	15°·2
" 10	27°·6	26°·9	31°·6	24°·1	17°·1
" 11	26°·6	29°·2	32°·4	20°·6	14°·1
" 12	26°·0	24°·3	31°·7	24°·3	16°·1
" 13	31°·9	37°·1	37°·4	23°·1	17°·6
" 14	31°·9	25°·0	37°·3	23°·9	19°·3
" 15	31°·2	35°·2	39°·3	20°·6	13°·4
" 16	36°·0	34°·2	43°·8	33°·3	28°·1
" 17	31°·4	28°·9	38°·9	28°·0	18°·2
" 18	39°·0	35°·8	41°·3	28°·0	21°·0
" 19	36°·9	31°·7	42°·6	31°·7	21°·9
" 20	27°·6	29°·8	41°·9	24°·7	16°·6
" 21	29°·0	30°·0	40°·9	27°·1	19°·1
" 22	35°·6	29°·3	43°·9	28°·9	18°·7
" 23	29°·3	31°·2	42°·2	26°·2	18°·3
" 24	30°·4	38°·8	38°·8	27°·8	18°·4
" 25	37°·9	42°·4	42°·4	34°·1	32°·2
" 26	47°·4	46°·9	49°·7	42°·2	39°·3
Means for					
Dec. ...	35°·8	36°·0	41°·9	31°·4	24°·4

The highest shade max. was $52^{\circ}8$, on Dec. 30th; the lowest shade min. $20^{\circ}6$ on Dec. 11th and 15th; and on the grass $13^{\circ}4$ on Dec. 15th.

The mean temp. (9 a.m., 9 p.m., max. and min.) $36^{\circ}3$, of December was very cold, being $6^{\circ}3$ below Dec., 1877, and $10^{\circ}0$ below Dec., 1876. Northerly winds, accompanied with intense cold and snow after the 9th, prevailed till the 25th, when an E. gale and thaw occurred, followed by strong S.W. winds, heavy rain, and mild weather to the end of the month. Snow fell on eleven days, it covered the ground from the 9th to the 15th, about 1.5 in. deep, and remained in the shade till the 25th, whilst the roads and paths were glazed with ice, rendering locomotion very dangerous, and causing many accidents. A strange phenomenon occurred on the 12th, the air temp. in the garden being $23^{\circ}1$ at 9.40 p.m. while it was 30° at the same time on the N. side of the house, 30 yards to the N.N.E., and on higher ground, the latter position feeling the influence of a light, warmer air from N.N.E., which had just set in from the sea, and which subsequently raised the garden temp. to $31^{\circ}1$ at 10 p.m., thus shewing the ameliorating effect of the sea on a sharp frost.

The barometer was generally low in December, but has oscillated considerably in the first ten days of January, 1879.

Rain fell abundantly from Dec. 15th to Jan. 7th (on every day except Jan. 4th and 5th), amounting to 6.06 in., the greatest falls being 1.46 in. on the 1st, 0.93 in. on the 2nd, 0.75 in. on the 6th, and 0.81 in. on 7th (much of the latter being snow). The 1st and 3rd inst. were warm, max. $49^{\circ}9$ and $52^{\circ}4$; but frost set in again on the 5th (min. $29^{\circ}2$), and is again becoming severe, 0.03 in. of snow having fallen last night, which is still remaining on the ground. A bitterly cold easterly gale blew from the 7th to the 10th; it was very violent on the 8th, and caused a very high sea and tides. The max. temp. to-day (11th) only rose to $27^{\circ}6$ after 9 a.m., and the min. occurred at 9 p.m., $21^{\circ}1$ in air, and $14^{\circ}1$ on grass.—Yours truly,

EDWIN E. GLYDE, F.M.S.

Kirkham, Babbacombe, Torquay, Jan. 11th, 1879.

P.S.—*Jan. 12th.* Last night was the coldest yet experienced this winter, the min. temp. falling to $19^{\circ}1$ in the air, and $12^{\circ}6$ on the grass; but at 9 a.m. to-day the temp. had risen to $25^{\circ}5$, and at 2 p.m. to $36^{\circ}2$, with a rapid thaw, falling barometer, S.S.W. wind, and overcast sky.

To the Editor of the Meteorological Magazine.

SIR,—As we are experiencing the severest weather we have had in this district since the winter of 1870-71, I send the low temperatures registered by my *minimum* thermometer (by Casella, on wooden stand, bulb 4 feet above ground) up to the present date. The frost set in on December 8th and continued until the 30th, when a thaw came on, and the max. reading reached 50° . On the 31st the mercury touched

53°·5, and snow and ice had almost totally disappeared. But on January 2nd the frost returned, and as yet shows no sign of again leaving us. I subjoin all the readings below 20°, with dates. The min. on December 24th is the lowest registered here since December 31st, 1870, when a temp. of 3°·6 was recorded.

		Min.			Min.
1878.	December 10th	... 17°·6	1878.	December 21st	... 14°·6
	„ 11th	... 13°·5		„ 24th	... 5°·0
	„ 12th	... 14°·5		„ 25th	... 6°·7
	„ 15th	... 19°·3	1879.	January 4th	... 15°·6
	„ 17th	... 16°·5		„ 6th	... 15°·0

I am, Sir, yours faithfully,

B. T. GRIFFITH-BOSCAWEN.

Trecalyn Hall, Wrexham, Jan. 28th, 1879.

To the Editor of the Meteorological Magazine.

SIR,—I notice that the cold reported in the *Standard* of the last few days differs very much from that which we have experienced here ; therefore I fancy a much colder blast has passed over us than over London, particularly on the 23rd, 24th, and 25th. The temperature here was as follows :—

Date.	9 a.m.	Max.	Min.	Grass.
Dec. 23rd ...	19°	30°	16°	6°
„ 24th ...	12	27	12	4
„ 25th ...	27	36	5	0

A remarkable fact was the great fall of temperature on the 24th. By 9 o'clock in the evening the glass had fallen to 8°; by 11 o'clock to 6°; and later on it fell one more degree. When the change took place I do not know, but by 9 o'clock in the morning the ther. had risen to 27°, and it has been thawing ever since.—Yours truly,

JOHN MATHISON.

Addington, Winslow, 27th Dec., 1878.

To the Editor of the Meteorological Magazine.

SIR,—I beg to forward you the readings of the min. and max. thermometers daily during the protracted frost in Mid-Lincoln. It set in on the 5th at night and froze every day for three weeks :—

Date.		Min.	Max.	Date.		Min.	Max.
Dec. 6	...	28°·0	36°·0	Dec. 17	...	17°·0	30°·0
„ 7	...	30°·0	34°·0	„ 18	...	19°·0	34°·5
„ 8	...	29°·0	33°·5	„ 19	...	26°·5	35°·0
„ 9	...	24°·5	33°·0	„ 20	...	18°·0	27°·0
„ 10	...	19°·0	30°·0	„ 21	...	13°·0	31°·0
„ 11	...	20°·0	33°·5	„ 22	...	24°·0	34°·5
„ 12	...	22°·0	30°·0	„ 23	...	16°·0	29°·0
„ 13	...	24°·5	30°·5	„ 24	...	16°·0	28°·0
„ 14	...	19°·0	24°·5	„ 25	...	10°·0	32°·0
„ 15	...	16°·0	33°·0	„ 26	...	31°·0	36°·5
„ 16	...	27°·0	31°·5				

The thermometer was below 20° on the extraordinary number of 11 nights. Prior to the 26th there was never more than 2 inches of snow on the ground.—Faithfully yours,

W. CARTER.

Bucknall, Horncastle, Jan. 1st, 1879.

REVIEW.

Nederlandsch Meteorologisch Jaarboek: voor, 1872. Tweede Deel.

Utrecht, Kemink en zoon, 1877.

THIS volume of Prof. Ballot's series is very late in appearing, but as regards the early portion which is devoted to barometric constants, the date is quite immaterial. In the pages 132–163 are given very full details respecting the rainfall of 1872 over the greater part of Europe. The first 24 pages of this article are devoted to giving the daily rainfall at 54 European stations. We are glad to see these tables, but we cannot help regretting the terribly long distances which so small a number as 54, spread over Europe from Nairn (by the bye, there is not one return from Ireland) to Constantinople, and from Madeira to the Gulf of Bothnia, necessarily involves. Looking at the extremely local and partial character of rain as compared with other meteorological elements, we are inclined to believe that if daily values are given they should be for stations tolerably close together.

After these come a series of tables, the design and object of which are admirable, and which are entitled to great praise.

One record appears to settle an enigma which has long puzzled us. Some old observations gave the rainfall at Coimbra, in the valley of the Mondego, as 224 inches; the same authority gave 23 inches for Lisbon; in 1872 the fall at Coimbra was 32·37 in., and at Lisbon 71·42 in. Hence there seems reason to believe that the old Coimbra record was fearfully wrong.

Lastly, there are tables of monthly rainfall in "Scotland and Elsewhere," which are unworthy of their companions. Not only are the stations in no kind of order, but misprints and puzzles seem plentiful, *e.g.*, the returns for Sillioth are printed twice over in one table, namely, on pages 162 and 163; but the return for February, 1872, is wrongly printed as 176·7^{mm} on one page, and rightly as 76·7^{mm} on the next. Then for Aberdeen we have three returns:—

Pages	1871.	1872.										
	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.
A 132–154...	45·2	69·3	108·4	48·6	70·7	74·9	125·5	49·0	53·6	155·6	117·6	148·0
B 156...	35·3	59·2	107·7	58·1	70·7	87·7	83·5	48·7	78·7	155·7	108·7	161·6
C 159...	42·4	78·2	129·2	57·9	76·2	95·5	97·5	50·6	85·4	176·8	111·2	182·3

It is, of course, possible that these discrepancies arise from three different records being employed; but even if so, we doubt the expediency, in an international work, of giving three records from one city when so many others are necessarily excluded for want of space, and, moreover, having reconverted these values into English measures, we find that A and B do not agree with any records for that year which we received from Aberdeen; C is evidently the return from Seafield Cottage, Rnabislaw.

HAILSTORMS AT NIGHT.

To the Editor of the Meteorological Magazine.

SIR,—As I believe it is unusual for hail to fall during night, and not often in winter, I send you an account of two storms within the last week or two. I also add an account of a hailstorm on the 6th July, 1877, remarkable not only for its violence, but from the thin layer of cloud from which it fell.

I sent an account of it at the time to Prof. D. Colladin, of Geneva, who devotes much time to the subject of hailstorms, their origin, &c.

Yours truly,

MICHAEL FOSTER WARD,

Rossinière, Switzerland, 3rd Jan., 1878.

F.R.A.S., F.M.S.

December 21st, 1878.—Cloudless day till 5 p.m.; heavy snow afterwards; 8 inches 9 p.m.; yield in water, 0·300 inches. A thunderstorm from 11 to 11.40 p.m.; temperature during storm, 24°·0. Lightning brilliant blue colour; thunder loud and long, and at the same moment as the lightning. Stars shining brilliantly through breaks in the clouds, which seemed to be not very dense. Heavy snow during storm, and large conical hailstones. Snow continued till 4 a.m., when the sky became cloudless. The snow and hail measured at 9 a.m. 6 inches deep; yielded 0·600 inches. Total fall from 5 p.m. to 9 a.m., 14 inches; yield 0·900 inches.

January 1st, 1879.—Fine; cir.-cu. from N.W.; max. 40°·0 during day; at 9 p.m., dry bulb 37°·0, wet 34°·0; at 2 a.m., 2nd Jan., 54°·0, 3 a.m. 44°·0; violent gale 3 to 4.30 a.m., with snow, hail, and rain; thunder very loud, lightning red and yellow, hailstones solid and conical. Calm, with rain after storm; 0·530 inches 9 a.m.

Hailstorm, 6th July, 1877.—6.30 a.m., air dead calm; storm came slowly up the valley from W., the cloud being very thin, the sun shining through during the storm. At a height of about 500 feet above us the sky was cloudless, the air warm, and the cloud in question seemed low in the valley. The lower part of the cloud was nearly down to the roof of the house. The storm lasted less than 10 minutes, during which rain and hail fell violently, accompanied with thunder and lightning. The hailstones were perfectly round, solid, and transparent, and averaged $\frac{3}{4}$ -of-an-inch in diameter; they lay to the depth of 2 inches, and were not melted till past 1 o'clock, though the max. of the day was 72°·5; temperature during storm, 54°·0: at 9 a.m., 60°·0. The air seems to have been full of electricity, as there had been a thunderstorm the previous evening (without rain), brilliant lightning all night, and storms at 1.30, 3.0, and 4.45 a.m. Amount of rain collected during these three storms, and that at 6.30 a.m., was 1·080 inches. The sky was clear immediately before and after the hailstorm. There were storms again at 5 p.m. and 6 p.m., rainfall 0·900 inches. No hail fell except at 6.30, and none of the storms lasted more than a quarter-of-an-hour or 20 minutes. I have never seen round hailstones here before; they have invariably been conical.

THE WEATHER IN DECEMBER.

During the first week the weather was generally of an unsettled and inclement character, interspersed with short periods of improved conditions. Atmospheric pressure was for the most part highest to the westward of these islands, and depressions consequently passed in a southerly or south-easterly direction over the United Kingdom or the North Sea, accompanied by north-westerly to northerly breezes, low temperatures and frequent rain and snow showers. These disturbances appeared, the first on the 1st, the second on the 5th, and the third on the 6th, and though not important enough to cause general gales on our coasts, they nevertheless gave rise to considerable increase of wind on those days, and gales locally at the mouth of the Channel.

After the 7th a great change came over the weather, the week soon proving itself to be the coldest and most wintry of the season thus far. The area of highest pressure (with the exception of the 12th) was shown on each day to the N., N.W., or W. of these islands, while disturbances, generally of slight importance, appeared to the S.W. and E. of us from time to time. The wind was therefore chiefly from the N.W. and N.E., and usually light or moderate in force. Temperature was low throughout the week, but especially on the 12th, 13th, and 14th, when the thermometer fell very low over England, more particularly in the N.E. The greatest cold recorded during this week was 10° at Shields early on the morning of the 14th, while the maximum temperature at that place on the preceding day was only 20° . The thermometer began to rise on the night of the 14th, and it appeared on the following morning that the frost was beginning to break up. This increase continued and extended over a good part of England on the 16th, when readings varied from 45° at Scilly to 22° at Ardrossan.

During the next period (15th to 21st) pressure, though rather unsteady, was not subject to any very considerable changes. On the 15th the barometer was highest over the N.W. of Spain, and lowest near the Shetlands, and westerly breezes prevailed generally, but on the 16th a rapid decrease of pressure took place over the Bay of Biscay, and a large area of low readings was shown over western Europe with light variable airs. This area of low readings subsequently moved N.E. to the Channel, where it filled up. On the evening of the 17th a rapid fall of the barometer was intimated from the Hebrides, and during the night of that day and the following day a deep depression passed S.E. across Scotland, causing brisk N. to W. winds generally, and fresh gales at Mullaghmore and Stornoway. The disturbance subsequently passed S.E. and E. across the North Sea, the mercury recovered over these islands, and the N. to N.W. winds blew with less force. On the 20th the barometer was rising generally, readings were very uniform over the neighbourhood of Great Britain, and light variable airs again prevailed, but on the 21st a fresh fall occurred over our northern coasts, and spread over these islands, bringing a further increase of force in the N. wind in the north.

Temperature was very low and oscillated rather largely during this week, a general rise being reported on the 15th and 18th, whilst on other days falls were reported. The weather was for the most part fair, though snow showers were frequent.

From the 22nd till the 24th, an area of low pressure lay to the eastward of the North Sea, and a region of high pressure off our western coasts; northerly to north north-westerly breezes prevailed on our coasts, with occasional snow showers and very cold frosty weather.

On the 24th the anti-cyclone from the west advanced over us; a further fall of temperature occurred, with fine dry weather and light winds. Dense fog and severe cold weather were developed over Central England, the thermometer falling quickly at night, so that the lowest temperatures of this winter were recorded. But on the following morning (25th) the change began; the anti-cyclone had moved on to North Germany; the barometer fell half-an-inch in the S.W., produced rather steep gradients for south-easterly winds in that region, and a fresh to strong gale from the S.E. set in. From this time till the

close of the month pressure was lowest on our W. and N. coasts, and S.W. to westerly winds, with high temperature, prevailed. These conditions continued much the same down to the close of the year. On the 31st a rapid fall of the barometer was reported from Scandinavia, but a slight rise over France and the S. of England. Deep depressions lay over the N. of Scotland and W. of Norway, and steep gradients for S.W. winds were shown over the Channel, England and Ireland. Rain was general over western Europe. H. E. M.

HASTINGS, & ST. LAWRENCE (ISLE OF WIGHT).

WE accidentally omitted to mention in the last number that we issued therewith, as a supplement, a report on the climate of Hastings, with copies of which we had been furnished by Mr. A. E. Murray, F.M.S.

This month we are favoured by the Rev. Clifford Malden, with a table of the rainfall from St. Lawrence Undercliffe, in the Isle of Wight; and it is a rather curious coincidence that two consecutive insertions should come from localities so frequently associated as winter health-resorts.

SUPPLEMENTARY TABLE OF RAINFALL IN DEC., 1878.

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

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	2.43	XI.	Castle Malgwyn ...	3.77
„	Littlehampton	2.31	„	Nantgwilt, Rhayader ...	5.71
„	Hailsham	2.49	„	Carno	4.64
„	St. Lawrence, I. of W....	1.93	„	Rhug, Corwen	2.81
„	Strathfield Turgiss	1.42	„	Port Madoc	3.44
III.	Addington Manor	1.46	XII.	Carsphairn	2.94
„	Oxford	1.30	„	Melrose	3.03
„	Northampton	1.66	XV.	Gruinart	2.71
„	Cambridge	1.12	XVI.	Grandtully .....	...
IV.	Sheering	1.14	XVII.	Tomintoul... ..	3.85
„	Diss	1.35	„	Keith	5.55
„	Swaffham	1.94	XVIII.	Dalwhinnie .....	.69
V.	Alderbury, Salisbury ...	1.65	„	Auchnasheen	2.53
„	Compton Bassett	1.80	„	Springfield, Tain	2.30
„	Dartmoor	6.67	„	Glenfinnan	4.95
„	Langtree, Torrington ...	...	XIX.	Watten	4.89
„	Cosgarne, St. Austell ...	5.55	XX.	Glenville, Fermoy	2.64
„	Taunton	2.20	„	Tralee	3.70
VI.	Bristol	2.05	„	Tipperary	1.72
„	Sansaw	1.54	„	Newcastle W., Limerick	1.91
„	Cheadle	2.55	„	Kilrush	2.08
„	Bickenhill Vicarage	2.04	XXI.	Kilkenny	1.57
VII.	Coston, Melton Mowbray	1.73	„	Kilsallaghan	1.69
„	Bucknall	1.49	„	Twyford, Athlone	1.72
VIII.	Walton, Liverpool	2.14	„	Belvedere, Mullingar ...	1.68
„	Broughton-in-Furness ..	2.58	XXII.	Ballinasloe	1.71
IX.	Stanley, Wakefield	1.02	„	Kylemore	4.68
„	Mickley, Ripon	2.41	„	Carriack on Shannon.....	1.65
X.	Gainford	2.46	XXIII.	Rockcorry	1.68
„	Unthank Hall	2.59	„	Warrenpoint	1.30
„	Shap	3.71	„	Newtownards ..	2.17
XI.	Llanfrechfa	3.88	„	Bushmills	4.08
„	Solva	5.23	„	Buncrana	3.96

DECEMBER, 1878.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which .01 or more fell.	TEMPERATURE.						No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Deg.		Date.	Deg.	Date.	In shade.	On grass.			
				Dpth	Date.										
inches	inches.	in.													
I.	Camden Town	1.46	— .04	.26	31	15	55.2	30	18.7	25	21	27			
II.	Maidstone (Hunton Court)...	1.49	— .13	.26	16	13	...	...	...	...	...	...
III.	Selborne (The Wakes).....	1.84	— .91	.33	27	12	55.0	31	11.0	14	24	27			
IV.	Hitchen	1.19	— .12	.23	27	15	52.0	30*	15.0	24	26	...			
V.	Banbury	1.77	+ .10	.31	25	18	52.0	31	8.0	25	28	...			
VI.	Bury St. Edmunds (Culford)...	1.31	— .18	.28	27	14	54.0	31	10.0	13	26	28			
VII.	Norwich (Sprowston).....	2.15	...	.36	27	19	...	...	...	...	...	...
VIII.	Bridport	2.37	— 1.00	.56	25	14	...	...	...	...	...	...
IX.	Barnstaple.....	3.80	+ .68	.75	28	16	56.0	30	14.0	11	...	...	
X.	Bodmin	5.30	+ .06	1.54	28	24	53.0	30	17.0	11	19	25			
XI.	Cirencester	1.77	— .52	.45	25	10	...	...	...	...	...	...
XII.	Shifnal (Haughton Hall) ...	2.16	+ .48	.32	1	13	51.0	31	11.0	25	29	30			
XIII.	Tenbury (Orleton)	2.08	— .38	.39	28	15	54.0	31	7.7	25	26	29			
XIV.	Leicester (Town Museum) ...	1.81	— ...	.42	26	15	52.5	31	6.9	25	22	29		
XV.	Boston	1.68	+ .19	.65	25	12	53.0	31	14.0	25	23	...			
XVI.	Grimsby (Killingholme)	2.14	...	.40	25	21	51.0	31	11.5	21	21	...	
XVII.	Mansfield	1.80	...	.62	31	13	51.7	31	7.8	25	24	24	
XVIII.	Manchester (Ardwick).....	2.80	+ .70	.44	1	16	54.0	31	10.0	24	24	...			
XIX.	York	1.41	— .39	.40	27	11	...	...	...	...	...	...
XX.	Skipton (Arncliffe) ...	3.03	— 1.52	.64	28	12	46.0	30	9.0	24	23	...			
XXI.	North Shields	4.82	+ 2.62	1.32	8	23	48.5	31	9.0	14	25	...			
XXII.	Borrowdale (Seathwaite).....	5.74	— 11.21	1.18	28	11	...	...	...	...	...	...
XXIII.	Cardiff (Crockherbtown).....	2.70	...	.75	28	10	52.6	29	19.5	11	24	...	
XXIV.	Haverfordwest	3.77	— 1.06	1.10	29	13	52.2	30*	9.0	11	22	28			
XXV.	Aberdovey .....	...	...	...	...	...	...	...	...	...	...	...
XXVI.	Llandudno	1.96	— .24	.30	19	19	53.0	31	20.7	13	17	...			
XXVII.	Dumfries (Crichton Asylum)...	...	...	...	...	...	...	...	...	...	...	...
XXVIII.	Hawick (Silverbut Hall)....	2.27	...	.38	28	19	...	...	...	...	...	...
XXIX.	Glasgow (Cessnock Park) ...	2.04	— 1.77	.47	11	9	...	...	...	...	...	...
XXX.	Mull (Quinish)	3.07	...	.62	30	14	...	...	...	...	...	...
XXXI.	Loch Leven	2.00	— 1.72	.60	31	9	...	...	...	...	...	...
XXXII.	Tyndrum (Ewick) .....	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Arbroath	2.49	— .25	.54	28	14	47.0	31	15.0	14	25	...			
XXXIV.	Braemar	2.01	— 1.76	.50	8	17	43.8	31	— 1.0	13	28	29			
XXXV.	Aberdeen .....	...	...	...	...	...	...	...	...	...	...	...
XXXVI.	Gairloch	6.43	...	1.18	30	20	...	...	...	...	...	...
XXXVII.	Portree	8.50	— 7.13	1.05	30	26	...	...	...	...	...	...
XXXVIII.	Inverness (Culloden)	1.30	— .63	...	...	18	45.0	31	13.8	28	23	31	
XXXIX.	Dunrobin	4.07	+ 1.67	.73	11	22	46.0	2	18.5	28	26	...			
XL.	Sandwick	5.70	+ 1.73	.62	28	28	44.4	5	22.3	28	18	28			
XLI.	Caherciveen Darrynane Abbey	3.57	...	.65	24	20	...	...	...	...	...	...
XLII.	Cork	3.09	...	.57	26	13	...	...	...	...	...	...
XLIII.	Waterford	1.78	— 2.64	.43	25	10	52.5	30*	14.5	15	15	...			
XLIV.	Killaloe	2.63	— .86	.39	11	12	53.0	30	11.0	17	26	...			
XLV.	Portarlington	2.05	— 1.14	.30	12	19	50.5	30	8.0	24	29	...			
XLVI.	Monkstown, Dublin	1.53	— 1.09	.54	27	9	51.0	26	11.0	13	...	...	
XLVII.	Galway	2.39	...	.60	27	16	54.0	30*	11.0	25	23	...	
XLVIII.	Waringstown	1.89	...	.30	29	22	50.0	30	5.0	24	26	30	
XLIX.	Edenfel (Omagh)	2.57	...	.37	28	16	49.0	31	0.0	24	30	...	
L.	Ballyshannon	3.24	...	.75	29	7	...	...	...	...	...	...

* And 31. † And 23. ‡ And 24. § And 25.

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

METEOROLOGICAL NOTES ON DECEMBER.

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.—Prevailing winds N. and N.W. for three weeks, afterwards W. and S. A sudden change from intense cold to comparative mildness on the 27th. Much fog, very little S.

CULFORD.—Exceedingly cold up to the 25th, when a sudden change took place, the S rapidly disappeared, and the weather remained mild to the end of the month. Easterly winds on four days only. Mean temp. $31^{\circ}2$.

SHIFNAL.—By far the severest December for 44 years (and probably more). The min. temp. was below 32° every day till the 29th, and in spite of the last three mild days averaged 25° , while the max. averaged only 34° ; the nearest approach was in 1835 when the average min. was 26° . The frost was usually accompanied by fog or mist, which on the 12th produced a splendid rime lasting four days. Although S fell frequently, it never exceeded 3 in. in depth. R fell nightly from 25th to close (29th excepted), and a rapid thaw set in on the 30th. Bar. throughout unusually low for a frost.

ORLETON.—A very cold winterly month, with a mean temp. about $7^{\circ}5$ below the average. The first week was generally cloudy, dry and cold; on the 8th severe frost set in, and continued without intermission till the evening of the 28th, when a sudden rise of temp. took place, and a rapid thaw soon cleared the ground of S, and caused all the rivers to overflow. During the frost there were frequent fogs and rime, but only trifling falls of S till the 21st, after which date much S mixed with R and sleet fell, and the roads were very icy. The fluctuations of the bar. were great, and it was generally low and unsteady, but the wind was never very strong till the 31st.

BOSTON.—Severe frost set in on the 6th, and lasted till the 28th, the ponds and drains were frozen sufficiently hard to bear skaters by the 10th. On the 25th the river Witham was frozen from Boston to Lincoln. The severe weather brought a great many strange birds to these parts, and several swans were shot at the mouth of the river. Unfortunately barbarians whose chief delight appears to consist in the pleasure of killing exist here as elsewhere, any many beautiful birds have fallen victims to their brutality, not only black birds and thrushes, but even three or four kingfishers, whose bright cheery presence skimming about along the ditches will be more missed perhaps than if the persons who shot them had disappeared instead.

KILLINGHOLME.—A month of real winter, the trees in the middle of the month beautifully covered with rime owing to prevailing fog. High winds on the last three nights. Large lunar halo on 9th.

NORTH SHIELDS.—S very frequent. Lunar halo on 9th. L on 16th.

WALES.

HAVERFORDWEST.—The most severe December since 1870. Hardly anything but S fell till the 28th, after which date a good deal of R fell.

LLANDUDNO.—A very wintry month, nothing equal to it in the last 20 years. In 1871 the mean temp. was nearly as low, and the min. even 2° lower, but the duration was only 14 days instead of 17.

SCOTLAND.

HAWICK.—S fell on twelve days, and amounted to 1.24 in., and 1.03 in. of R fell on seven days. The thaw on the 28th, and the heavy R which accompanied it caused a high flood in the Teviot. The snowfall has been the severest and longest in duration experienced here for many years, but the S has protected the shrubs, so that they are not much worse for the low temp. of 5° which was frequently registered. The feathered tribe suffered very severely.

QUINISH.—Weather unusually severe. Frost on 17 days. S heavier than for several years past. The wind has been from the N. during the whole month with rare exceptions.

BRAEMAR.—A very heavy fall of S. The most intense frost since 1860.

PORTREE.—Unprecedented snowfall, with severe frost, from 7th to 28th inclusive. So much S has not been known since 1812, and, according to tradition, not for 200 years previously.

DUNROBIN.—Railway communication N. of this has been much impeded by snowdrifts. Very little progress has been made with out-door labour.

SANDWICK.—The most severe December for a great number of years. The frost, which began on November 23rd, continued (with partial thaws) till the end of December. The severe snowdrift on 21st, with the wind 55 miles an hour, and some drift also on the two following days, blocked up the roads, and the farmers have not been able to plough or get up any quantity of turnips for their cattle during the whole month. The only T and L we had during the whole year was on the 19th, between 8 and 9 a.m.

IRELAND.

DARRYNANE.—The coldest month for many years. Hard frost from 8th to 24th inclusive, and S at intervals. The most severe winter since 1854-5, and then, though there was more S, the frost was not so severe. Winds chiefly N.E. and moderate, but a fresh gale from N.W. on 31st.

KILLALOE.—A month of great severity, the temp. falling as low as 11° on two nights. Canals and parts of lake frozen hard enough for skating; ground covered with S from 13th to 28th.

MONKSTOWN.—The month of December was one of unprecedented severity. Frost commenced almost with the month, and continued with two very slight thaws till 25th, when a gradual but decided thaw set in, accompanied by considerable wind. Much S on 8th, 9th, 10th, 11th, and 22nd. Skating continued from 5th to 26th. Considerable and sudden fluctuations of the bar. during the whole month.

WARINGSTOWN.—Continuous frost and S. On the whole the most severe December since 1854, though the ther. was lower (2°) on the 2nd January, 1867, than it has been this month. A thaw set in on Christmas-day, and continued till end of month; however, before the new year was many hours old a sharp frost set in, and continues (January 3.)

EDENFEL, OMAGH.—With the exception of one night, frost prevailed during the entire month. The settled frost which commenced on 8th culminated in a temp. of zero in the night of the 24-25th, and was the most prolonged (considering its intensity) of which I can find any record in the present century.

HEAVY SNOW.

To the Editor of the Meteorological Magazine.

SIR,—I wrote to you about an unprecedented fall of snow on the night of Nov. 11; but that has been in some respects surpassed by a fall on the night of the 7th inst. On this occasion, however, the snow was a much longer time in reaching the same depth, and was also lighter. It commenced about 7 p.m., and though probably not a continuous fall, was 12 inches deep by 8 a.m. on the 8th! A good deal more fell after that, but without much increasing the depth; at 3 p.m. it was 12½ inches, which, when melted, produced about 1.5 in. of water. At night there was a further fall, making the depth 17 inches by the morning of the 9th, being deeper than has been reached for very many years. It looked magnificent on the trees, but was very injurious to many.—Yours truly,

T. W. BACKHOUSE.

Sunderland, December 13th, 1878.