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1872.

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AND ALL BOOKSELLERS.

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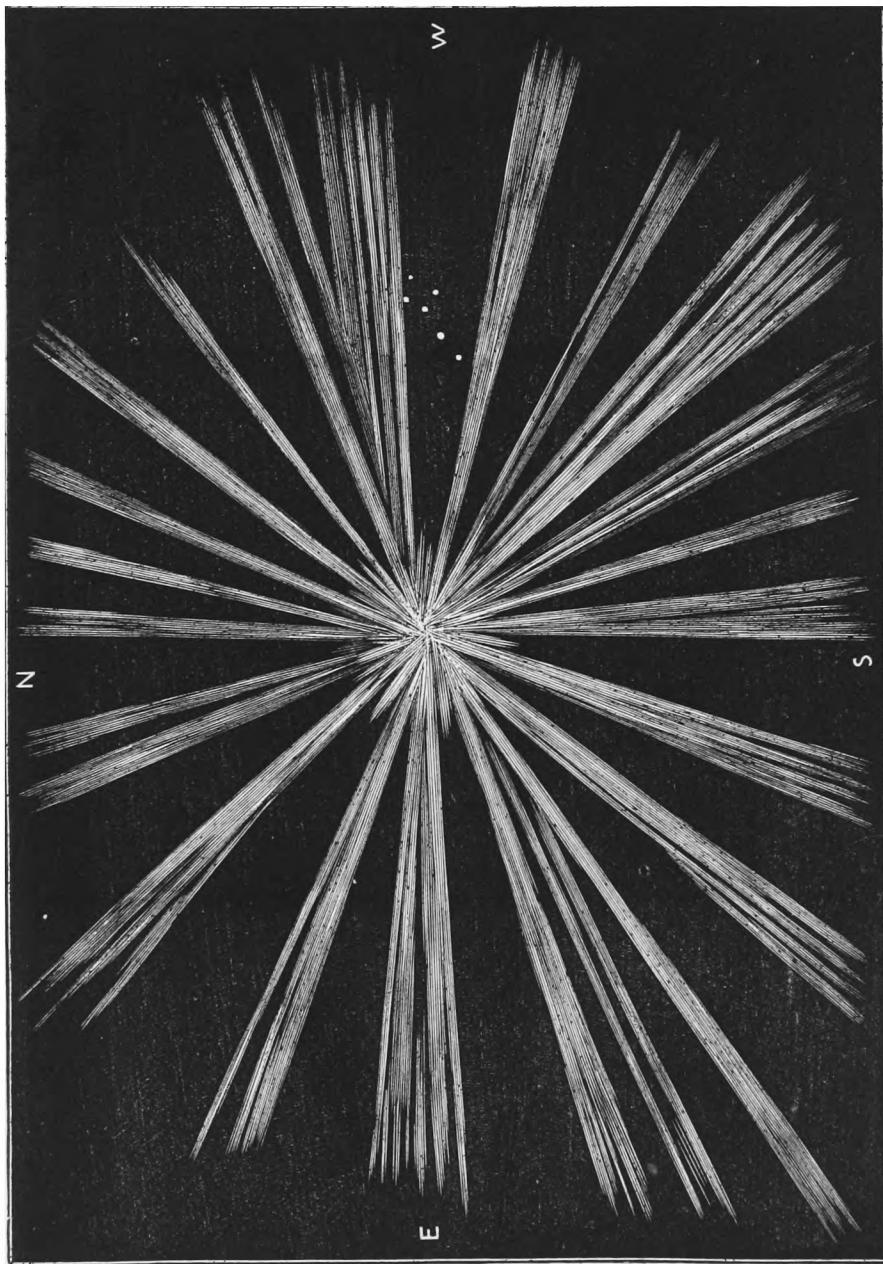
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AURORA OF FEBRUARY 4TH, AS SEEN AT FULTON PARSONAGE, BARNSTAPLE.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

LXXIII.]

FEBRUARY, 1872.

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or 5s. per ann. post free

INTRODUCTORY-

It has been our practice to address a few words to our readers at the commencement of each volume. They have seldom if ever been words of promise, because we prefer deeds to words, and on the present occasion we have the less reason for departing from precedent, since the six completed volumes are the best indication of what the seventh is likely to be. That much of our success is due to our able correspondents, is patent to everyone, and fully appreciated by ourselves. Long may it remain so, and largely may their number increase. We may, perhaps, be permitted to draw our readers' attention to one fact—our first object in the conduct of this Magazine, is not as with many to make money, but to advance the science to which we are devoted; and proof of this is afforded by our having made no increase in the price, while we have more than doubled the contents. Our readers and correspondents have only by their recommendation to continue to increase the circulation, and they will secure still further enlargement.

A SOUTHERN AURORA.

To the Editor of the Meteorological Magazine.

SIR,—A southern aurora in these latitudes is an occurrence of so unusual a nature, that I hasten to send you a few hurried notes made last evening.

About 6 p.m., while it was still twilight, a patch of red diffused light was observed near Orion's belt. At 6.15, several intermittent white streaks suddenly made their appearance in the south, radiating downwards from the zenith, instead of upwards from the horizon; and before five minutes had elapsed, the whole of the southern half of the heaven was a mass of brilliant light—a broad red band stretching along the horizon, and numberless radii above it, which all converged

to a point high above our heads, and situated about 10° E. of the Pleiades.

Up to 6.55, no auroral light was distinguishable in the northern portion of the sky; but at that moment there was a sudden outburst of rays from the central point, covering the entire heaven in every quarter, several of the rays in the E. and E.N.E. being, however, especially remarkable for their width and colour.

The sky remained absolutely without a cloud until nearly 8 o'clock, when there were only the remains of a few white streaks visible, and an hour later rain clouds, with a thick mist, obscured even the brightest of the stars.

The following are my notes taken at the time:—

Sunday Night, February 4th, 1872.

- | | |
|-----------|--|
| 6. 0 p.m. | Diffused red light near Orion's belt, in S.E. |
| 6.15 „ | Several white rays in the South, diverging from near the Pleiades. |
| 6.20 „ | Streaks cover the whole of the southern sky. |
| 6.35 „ | Brightness diminishes for three minutes. |
| 6.45 „ | A combination of bright rays in the E. and S.E. |
| 6.55 „ | Outburst of rays in every part of the sky, all diverging from a point 10° E. of the Pleiades, where the ends of the rays are very distinctly seen to interlace each other for a length of about 4° , producing a great intensity of light. (See Frontispiece.) |
| 7. 0 „ | Maximum brightness. Several broad streaks in the E.N.E. are of a brilliant red colour. The appearance of the sky at this moment was remarkable in the extreme, every portion of it being equally lighted up by the innumerable rays, which all diverged from the central point above mentioned, and reached down to the horizon, in shape and arrangement not unlike the ribs of an open umbrella. |
| 7.30 „ | A visible diminution in intensity. |
| 8. 0 „ | Up to the present time the sky has been cloudless. Now a bank of heavy cumuli are rapidly drifting up from the south. A few white rays still point towards the Pleiades. |
| 9. 0 „ | Thick clouds above, and mist below, rain falling. No stars visible. |

The barometer corrected to sea level stood at 29.82 during the two hours the aurora was visible. At 10 p.m., when the rain had increased, it fell .04 inch.

The above observations were taken from the grounds of Pilton Parsonage, on the top of the hill, which rises to the north of the town of Barnstaple.

TOWNSHEND M. HALL, F.G.S.

Pilton, Barnstaple, Feb. 5th, 1872.

To the Editor of the Meteorological Magazine.

SIR,—On Sunday evening, 4th inst., a beautiful display of aurora was observed here. My attention was first directed to it at 6.4 p.m. (G.M.T.), at which time there was a fiery glow over a considerable portion of the southern sky, much resembling the reflection of a distant conflagration. Shortly after, an almost complete auroral arch of faint orange red light, similar to that at first observed, was noticed, extending from E. above, and partly embracing δ , ϵ , and ζ Orionis, to W., its altitude (by estimation) at the centre being about 40° , and its extent something like 120° . For a short time this glow was most intense in S.S.E. at a great altitude; but the display attained its greatest intensity about 6.15., when a number of rays or streamers of whitish blue and orange red light appeared, as if radiating from a point near ζ , α , and κ Persei. At 6.20 nothing was observed but a widely-diffused fiery glow, which must have continued more or less during the whole evening, as it was again observed by me at 8.25.

I am, Sir, faithfully yours,

JOHN JAMES HALL, F.M.S.

Fulwell, near Twickenham.

To the Editor of the Meteorological Magazine.

SIR,—A magnificent display of aurora was observed here last evening.

It was first observed about 5.30 p.m., when the clouds became tinged with red; about 6 p.m. the sky cleared, and the horizon from E. to S.S.W. was lit up with a brilliant white light, with streamers rising to about 30° ; the rest of the sky, with the exception of the N. horizon, which was perfectly free from aurora, was covered with waves of a deep blood-red colour; this continued till 9 p.m., when the sky again became cloudy. About 8.40 there were a few streamers in the N.W., but the focus of the display was about S.S.E., and it would seem to have been the southern aurora, the northern sky, to about 20° from the horizon, with the exception just mentioned, being entirely free from light.—Yours truly,

THOMAS PAULIN.

Winchmore Hill, Feb. 5th, 1872.

To the Editor of the Meteorological Magazine.

SIR,—It may interest you to know that the rainfall of the past month has been 5.36 inches at Uckfield Observatory, and no less than 7.46 inches at Crowborough Beacon Observatory. At the latter station 2.99 inches fell during the first eight days, and 4.47 inches during the remainder of the month. On 23rd and 24th an immense quantity of water passed along the Uckfield brooks, for which I was quite unable to account, until I had measured the rainfall at Crowborough.

The rain was described to me as being *extraordinarily heavy* during the afternoon and night of 23rd, with a great quantity of hail.

Last evening (Sunday) we had a brilliant aurora borealis; it stretched across the sky from E. to W. horizon, at 6.10 p.m., and at an *apparently* very low elevation. It was only clearly seen for about 20 minutes, when some heavy clouds passed over, and for the time hid

the phenomenon. They became somewhat thinner about 7.30, when the whole sky appeared of a carmine tint, and tinged the clouds with the same hue, presenting a very remarkable appearance. The sky became nearly clear of clouds about 11 p.m., when there appeared a strong auroral light over the whole of the northern sky, with a large patch in the N.E. by E.; it was of a dark greenish hue. I did not observe any positive streamers.—Yours very truly,

C. L. PRINCE.

Uckfield, February 5th, 1872.

To the Editor of the Meteorological Magazine.

SIR,—On going out of doors yesterday (Sunday) evening, a little before 7 o'clock, when twilight was entirely gone and there was no moon, I was struck with a general diffusion of light all over, notwithstanding that the sky was clouded. It seemed as light as it would be if the moon had been at least a quarter old. At first the light seemed strongest in the south. Soon afterwards I noticed a blush of red through the clouds overhead, which led me to suspect that the light must have been caused by aurora borealis. I again noticed this general diffusion of light several times, till 10.30, and also evident streams of auroral light, of a crimson colour, in different parts of the sky, which became less covered with clouds about 9 o'clock. I should imagine that, had the sky been clear all the evening, a very fine display of aurora would have been visible. I heard to-day that a labouring man had remarked, respecting this light, that "it began in the S. at a quarter before 7, and went round by W. to the N."

I may take this opportunity of mentioning, respecting the weather in January, that it was here a mild and wet month. On no day did the maximum temperature fall below 38°. On three days the minimum was as high as 39°. The extremes were 51° on January 4th, and 28° on the 15th and 16th. The rainfall amounted to 3.56 inches, the greatest fall on one day being on the 23rd, viz., 0.58 inch, when, also, the barometer made such a remarkable descent. I cannot be sure of the lowest point reached, as the turn seems to have taken place very early in the morning of the 24th. But before midnight of the 23rd, my cottage barometer (256 feet above the sea), stood at 28.53 inches, and at 8 the next morning it was at 28.55 inches. At the same time my aneroid, which had been cleaned and set by Casella in September last, pointed to 28.17, but had been lower before I set it, though I cannot say how much.

I have often observed that in a long fall of the barometer, there occurs an occasional stoppage, and even a brief rise. It was notably so in the afternoon of January 23rd, when a rise of at least 0.04 inch took place before the final rapid descent of nearly half an inch in two or three hours.

I heard one clap of thunder on January 6th at 1.22 p.m.

Yours truly,

EDWARD MAXWELL.

High Roding Rectory, Dunmow, Essex, Feb. 5th, 1872.

To the Editor of the Meteorological Magazine.

SIR,—There was a brilliant display of aurora here on Sunday evening last, Feb. 4th. It was first observed in the E., at about 6 p.m., and moved gradually towards the S. At 7.30 it was moving back again through the E. to N.—the whole heaven from S.E. to N. being brilliantly lighted up. The appearance was chiefly that of a deep rose colour, overspreading the sky, through which the stars could be faintly seen. The phenomena rapidly faded away after 8 p.m.

BOSCAWEN T. GRIFFITH.

Trevalyn Hall, near Wrexham, Denbighshire, Feb. 7th, 1872.

To the Editor of the Meteorological Magazine.

SIR,—At 6.40 this evening my attention was called to an extraordinary state of the sky, which I perceived to be a deep red aurora, extending from S.W. round by S. and E. to N.E., radiating from a point midway between the Pleiades and Capella. In the N.E. it was a deep blood-red colour, forming a band some 10° or 15° wide, the red apparently crossing the primary radiation. In the S. there was sufficient white light to enable me to see the hands of a watch.

The following is the substance of a few rough notes, which were taken down. At first there was nothing visible in the N.W., which is very unusual :—

- 6.48 p.m. Radiation commenced towards N.W.
- 6.50 „ Red tint spreading to W. Deep red in N.E., approaching horizon.
- 6.54 „ White light rapidly spreading over N.W. Red growing faint.
- 6.59 „ A band of yellow through the red at N.E. Aurora growing faint generally.
- 7. 5 „ Band of bright red from the radiant point through Gemini, and towards the W. in an opposite direction.
- 7.10 „ Dark clouds from S. obscuring aurora, which thus appeared to be *beyond* these clouds.
- 7.25 „ Slight red to N.E., and faint to W.
- 7.50 „ Aurora almost vanished.
- 8.30 „ Rays of blue, red, and white to W. and N.W. and N.E.
Radiant point now near γ Aurigæ.

Nearly the whole time there was a clear space of 3° or 4° in diameter round the point from which the rays seemed to radiate. Although the changes in form, &c., were rapid, there was no visible motion. The time mentioned is Dublin time.—Yours sincerely,

G. PIM, JUNR.

Easton Lodge, Monkstown, Co. Dublin, Feb. 4th, 1872.

There was nothing unusual in pressure or temperature, barometer standing 29.67, temperature 43°.

9.25. A broad band of red light in E. and N.E. radiating from Pollux.

THE BAROMETRIC DEPRESSION OF JANUARY 24TH, 1872.

Low barometric pressure in the West of Ireland and in Scotland is not unusual, and several instances are on record of pressure decreasing to less than 28 inches. But in the south and south-east of England the pressure seldom falls below $28\frac{1}{2}$ inches; one of these rare cases occurred on the date above-mentioned, when during several hours in the early morning the pressure over the whole of Southern England was below 28.50. Unfortunately the data at present in our possession are not sufficient to enable us to thoroughly explain the phenomena which occurred, and this deficiency arises from three causes. (1) Many of our correspondents are not aware that we desire copies of *all the barometric readings* which they took between 1 a.m. on January 23rd and 1 a.m. on January 25th. (2) Scarcely any observers seem to have been sufficiently enthusiastic to "sit up" with their barometers. (3) Very few self-recording barographs are yet established in the area principally concerned, and of these two (if not more) were undergoing repairs.

We append a few of the letters with which we have been favoured, a table of the lowest observed readings, distinguishing those which are merely the lowest observed, and those which by observations, both shortly before and after, are known to be true minima—a letter upon the subject, which appeared in the *Times*, and a table of baric minima at Greenwich for 30 years.

Even from the following data some hints as to the outline and path of the depression may be gleaned—such as that it seems (1) to have travelled in a north-easterly direction, (2) at a rate of some 30 or 40 miles an hour (3) along a track somewhat east of a line joining the Severn and the Wash. The lowest pressure yet reported to us is from Tweed, near Lymington, viz., 28.07 at 2.0 a.m.; but we are not yet informed as to this being corrected for temperature. At Upwey, near Dorchester, it was falling at, and after 2 a.m., and, from the evidence before us, we think it cannot have been at its lowest at Tweed so early as 2 a.m. Doubtless, we shall be favoured with further particulars. Meanwhile we may remark, that at Upwey the true minimum fully corrected was 28.208 at 2.40 a.m.

To the Editor of the Meteorological Magazine.

During a furious gale from midnight to 9 a.m. on Wednesday last, the pressure recorded by Osler's anemometer at 2 a.m. was 28 to 35 lbs. on the square foot, a velocity of 75 to 85 miles an hour, the wind veering from S.E. to S.S.W. At this hour the barometer corrected and reduced to 32° Fahr., sea level, read as low as 28.400 inches. The barometer still continues very low, reading this morning at 9 a.m. 28.920 sea level.

T. L. M.

Guernsey, January 25th, 1872.

The greatest pressure and lowest barometer reading occurred at 2 a.m.; at 9 a.m. on the 24th, barometer read 28.847 sea level—32° corrected.

To the Editor of the Meteorological Magazine.

SIR,—As I suppose you will be publishing the excessively low barometer readings during the past month, I beg to enclose those taken during the late storm.—Truly yours,

J. INGLEBY-MACKENZIE, M.B., Cantab, F.M.S., M.S.M.S.

Highest reading of maximum temperature, January 4th, 53°·3.

Lowest reading of minimum, January 15th, 30°·0.

Frost registered on 2 days, 10th and 15th.

Rain fell on 30 days ; quantity 5·21 inches.

Average rainfall in January, 1865—1871, = 3·91.

Average number of rainy days, = 18.

January 21st, 9 a.m.	.....	29·668	.....	46·0
„ „ 3 p.m.	.....	29·630	.....	49·0
„ 22nd, 9 a.m.	.....	29·433	.....	48·0
„ „ 3 p.m.	.....	29·251	.....	49·0
„ „ 11.30 p.m.	.....	29·100	.....	51·0
„ 23rd, 9 a.m.	.....	28·729	.....	50·0
„ „ 3 p.m.	.....	28·779	.....	50·0
„ „ 12 p.m.	.....	28·489	.....	51·0
„ 24th, 9 a.m.	.....	28·717	.....	50·0
„ „ 3 p.m.	.....	28·787	.....	51·0
„ „ 12 p.m.	.....	28·790	.....	51·0
„ 25th, 9 a.m.	.....	28·879	.....	50·0
„ „ 3 p.m.	.....	28·947	.....	50·0

Sidmouth, February 1st, 1872.

Readings of the Barometer at Upwey, Dorchester, Dorset, 1872.

70 feet above mean sea level, corrected and reduced to 32°.

Date and Hour.	Reading reduced to 32°	Sea level pressure.	Temp. on Ther. stand.	Remarks.
Jan. 23rd, 9 a.m.	28·681	28·754	46·3	S.W. strong.
„ 9 p.m.	·676	·749	47·5	S.E. moderate, and heavy rain.
„ 11.45 „	·446	·519	...	„ „
24th, 0.15 a.m.	·394	·467	...	
„ 0.45 „	·328	·401	46·3	
„ 1.20 „	·254	·327	...	S. rising.
„ 2.20 „	·161	·234	...	S. increasing, rain ceased.
„ 2.40 „	·135	·208	...	
„ 3.15 „	·146	·219	...	{ S.W. a furious gale (which moderated between 5 and 6 a.m.)
„ 3.30 „	·191	·264	...	
„ 7.15 „	·486	·559	...	
„ 9.0 „	·665	·738	47·0	N.W. strong.
„ 11.30 „	·719	·792	...	S.W. strong.
„ 6.0 p.m.	·777	·850	...	
„ 9.0 „	·783	·856	46·7	S.W. strong.
25th, 9.0 a.m.	·841	·914	48·5	S.E. brisk.
„ 9.0 p.m.	·959	29·032	42·0	E. gentle.

Barometer, a standard by Negretti and Zambra, number 589, compared at the Kew Observatory, and has a platinum ring to the tube.

Highest reading of barometer in the month, 9 p.m., 12th ...	30·152
Lowest " " " 2.40 a.m., 24th ...	28·135

Range 2·017

JOHN MILLER, M.R.C.S.L.

To the Editor of the Meteorological Magazine.

SIR,—I beg to forward you the readings of my barometer during the last few days, as well as the memoranda I made on the state of the weather. The barometrical readings are all corrected for index error, temperature, and sea level.

January 22,	3 p.m.	29·396	
" "	9 "	29·308	
" "	12 mid.	29·218	
" 23	9 a.m.	28·913	
" "	3 p.m.	28·884	
" "	9 p.m.	28·866	
" 24	3 a.m.	28·432	Lowest observed by me.
" "	9 a.m.	28·746	
" "	3 p.m.	28·885	
" "	9 p.m. ..	28·974	
" 25	9 a.m.	28·993	
" "	3 p.m. ...	29·015	

January 22nd. The barometer fell all day, and towards midnight the wind began to blow strong from S.E., which developed into a very heavy S.S.E. gale during the early hours of the 23rd, accompanied with a driving rain. Shortly after noon, a sharp hailstorm occurred, and during the rest of the day, the wind having veered to S.W., it blew very strong from that quarter. The barometer remained very low all day, and was still falling after 9 p.m. After midnight the force of the wind increased, and between 2 and 3 a.m. of the 24th, a heavy and strong gale from the S.S.W. was blowing, increasing in power every minute. I recorded the lowest reading at 3 a.m. The gale still increased in violence, and appeared to reach its maximum about 4 a.m., when the wind veered somewhat W. It is reported that the barometer stood at 28·30 about 4 a.m., but as it is an uncorrected reading, and not from a standard instrument, I will not authenticate it. Heavy squalls of rain prevailed throughout the morning and early afternoon, and about 11.30 a.m. a very severe hailstorm occurred, lasting for some 10 or 12 minutes. During these three days 1·32 inches of rain fell, viz., 0·28 on 22nd, 0·82 23rd, and 0·22 on 24th.

I am, yours obediently,

W. J. HARRIS, F.M.S.

Worthing, Jan. 25th, 1872.

To the Editor of the Meteorological Magazine.

SIR,—Your account of the extraordinarily low barometric pressure of yesterday in to-day's *Times*, induces me to send my observations,

which will interest the meteorological world, if you like to insert them in the *Meteorological Magazine*. A first-class standard barometer, corrected and verified by Glaisher, gives every weight to all observations, which were by myself, in person.

Yours very truly,

R. BURLINGHAM.

Lansdowne, Evesham, Jan. 25, 1872.

NOTES.—All observations corrected for capillarity, index error, and reduced to 32° at sea level (124 ft. assumed height).

At greatest depression steady rain and gusty wind from S.S.W., shifting to W.N.W., at barometer rising; but wind could not be called fresh at any time; a fine sunny dry day succeeded. Total rain, 0·850 in.

Much rain must have fallen about the neighbourhood, as the river Avon rose 8 ft. 8 in. above its normal level.

1872, January 24th.

a.m.	Sea level pressure.	
2.30	28·443	
3.0	28·376	Falling at the rate of ·134 per hour.
4.20	28·230	„ „ „100 „
4.35	28·216	
4.50	28·196	
5.5	28·185	„ „ „051 „
5.20 lowest read,	28·179	
Absent $\frac{3}{4}$ hour; <i>in all probability</i> it fell at the same rate another $\frac{1}{4}$ hour.		
6.5	28·223	} Rising ·168 per hour !!
6.20	28·263	
6.35	28·307	
6.50	28·347	
7.5	28·386	} „ „091 „
7.20	28·418	
7.35	28·449	
8.35	28·540	
10.5 p.m.	28·821	

January 25th.

2.0 a.m.	28·818	Slow rising 18 hours.
2.35 p.m.	28·970	
6.0 p.m., bar. still under 29·000, being nearly 48 hours in such a depressed state.		

Mr. G. J. Symons writes under date, 62, Camden-square, Jan. 24 :—

“The barometric depression which passed over the metropolis in the early hours of this morning having not only been unparalleled during my own period of observation (16 years), but with, I believe, only two exceptions during the present century, I beg to forward notes of some of the observations made here, together with a few remarks on analogous cases during the present and preceding centuries.

“The present depression may be considered to date from 9 p.m. on the 21st inst., when the pressure was 29·691 (all readings quoted are thoroughly corrected and reduced to sea level), decreasing gradually until the afternoon of the 22nd, and then more rapidly, passing below 29 inches in the early morning hours of the 23rd, and reaching the low point of 28·832 at 1 p.m. yesterday; it then turned to rise, and was 28·848 at 9 p.m. From this low starting-point the second fall commenced, the details of which are given in the following table :—

Time.	Pressure.	Time.	Pressure.
	Inches.		Inches.
Jan. 23. 9 0 p.m.	... 28'848	Jan. 24, 3 45 a.m.	... 28'382
— 11 15 „	... 28'785	— 4 0 „	... 28'365
— 11 30 „	... 28'775	— 4 15 „	... 28'354
— 11 45 „	... 28'743	— 4 30 „	... 28'344
— Midnight	... 28'730	— 4 45 „	... 28'338
Jan. 24. 0 15 a.m.	.. 28'716	— 4 47 „	... 28'332*
— 0 30 „	... 28'695	— 5 0 „	... 28'345
— 0 45 „	... 28'675	— 5 15 „	... 28'348
— 1 0 „	... 28'645	— 5 30 „	... 28'350
— 1 15 „	... 28'618	— 5 45 „	... 28'355
— 1 30 „	... 28'593	— 6 0 „	... 28'360
— 1 45 „	... 28'574	— 6 15 „	... 28'372
— 2 0 „	... 28'541	— 6 30 „	... 28'386
— 2 15 „	... 28'506	— 6 45 „	... 28'414
— 2 30 „	... 28'482	— 7 0 „	... 28'420
— 2 45 „	... 28'455	— 8 0 „	... 28'538
— 3 0 „	... 28'432	— 9 0 „	... 28'616
— 3 15 „	... 28'414	— 11 0 „	... 28'756
— 3 30 „	... 28'391		

* Lowest pressure.

“I am not aware that the point to which the barometric pressure at sea level in the neighbourhood of London may be expected to diminish once in each year has ever been computed or stated; I believe it to be within a few hundredths of 28 $\frac{3}{4}$ inches (say 28'70 to 28'80). Unless, therefore, the pressure falls below this point, it is simply a normal state of things, but when, as this morning, it falls nearly half an inch below its probable *minimum* point, it becomes a special phenomenon worthy of careful notice. In my own observations, dating from 1857, there is nothing that at all approaches 28'332, the lowest reading being on February 11, 1866, at 4.30 p.m., 28'606, and December 26, 1859, at 6 a.m., 28'629. In the Royal Charter gale the lowest reading here was on October 26, 1859, at 0.35 a.m., 29'068 inches.

“It is, therefore, evident that for parallel instances we must go much further back, and then we come upon observations of a less complete character, uncorrected for instrumental errors, for temperature, and for elevation. Singularly enough, the only instances, which I can convince myself have exceeded the present are at intervals somewhat tending towards equidistance—viz., 1791, 1821, 1843, 1872. Before proceeding to state the facts which I have been able to collect respecting these instances I desire to state that for the Sea Level pressures given in parentheses I alone am responsible, and that while on the one hand I have endeavoured to approximate as closely as possible to the truth, and am quite ready in a proper place to give my reasons for the corrections applied, I, on the other hand, maintain that uncorrected readings never ought to be published:—

“1791.—Of this depression I have only two notices. One is, that at Sion House on January 20 (at 8 a.m. ?) the barometer fell to 28'10 (=28'15 at sea level), and the other, that on the same day, but probably an hour or two later, it was 28'20 in Paternoster-row (=28'28 at sea level). The *minimum* in this instance probably lay between 28'15 and 28 inches.

“1821.—Much more copious details of this depression have been preserved. Professor Daniell (residing near Russell-square) recorded 28'12 on the night of December 24, (=28'20 at sea level), but from other evidence we know the barometer continued to fall until about 5 a.m., on December 25, at which hour it was recorded as 27'83 (=27'93 at sea level), at Tottenham by Luke Howard, and 27'89 (=28 at sea level) at the Royal Observatory, Greenwich. At 6 a.m. on the same day, Mr. Squire recorded 27'73 (=28'10 at sea level) at Epping, and at 8 a.m. 28'20 (=28'25 at sea level) was recorded at Sion House. We may, therefore, look upon that depression as greater than, but not so sudden as, that which passed over us this morning.

"1843.—This depression was carefully observed by Mr. Glaisher, at the Royal Observatory, and a very interesting note was written by him and published in the Greenwich volume for that year. The lowest pressure on January 13, at 0.53 p.m. reduced to sea level, was 28.266, or about one-sixteenth of an inch lower than that recorded here this morning. One feature in the gale of 1843 seems to have been so exactly repeated this year that it may be desirable to call attention to the coincidence. Thunder and lightning are infrequent in January, but in 1843 two "very vivid" flashes of lightning, with "very long crashing" peals of thunder, occurred during the storm, and a correspondent at Hastings reports a single "vivid flash of lightning followed instantly by a heavy peal of thunder" at 4.5 p.m. yesterday.

"I sincerely hope that a similar parallel will not prevail with respect to shipping casualties, which in 1843 amounted to at least 240 vessels, 450 lives, and ships and cargoes of an aggregate value of £825,000."

Lowest observed reading of Barometer on January 24th, Corrected and Reduced to Sea Level.

Station.	Time.	Reading.	Instrument.	Minima.
Old Berwick, Alnwick	8 a.m.	28.51	Not a standard.	.....
Newcastle-on-Tyne ...	9 "	28.393	Verified standard.	.....
Gainford, Darlington..	9 "	28.335	" "	Lowest observed
Killingholme, Ulceby..	9.40 "	28.17	Compared Aneroid.	True minimum
Ripley, Derbyshire ...	9 "	28.301	Verified standard.	Lowest observed
Derby	9 "	28.460	Standard.	" "
Wolverhampton.....	6 "	28.248	Compared aneroid.	" "
Geldeston, Beccles.....	7.50 "	28.38	" "	True minimum
Lansdowne, Evesham..	5.20 "	28.179	Verified standard.	Lowest observed
Haverfordwest	3 p.m.	28.588	" "	" "
Berkhampstead	3 a.m.	28.433	.....	" "
Winchmore Hill	4.15 "	28.35	.....	" "
Camden Square	4.47 "	28.332	Verified standard.	True minimum
Finsbury	5 "	28.34	Aneroid.	Lowest observed
Clifton	4.30 "	28.18	" "	" "
Forest Hill	4.10 "	28.38	.....	.....
Chiselhurst	3 "	28.458	Verified standard.	Lowest observed
Beckenham (Parkside)	4.55 "	28.395	" "	" "
Bath, Paragon	5 "	28.403	.....	" "
Haywards Heath, Sussx	4 "	28.40	Not a standard.	" "
Westward Ho ! Devon	3.45 "	28.38	" "	" "
Lymington	4 "	28.355	Verified standard.	" "
" (Tweedside)	2 "	28.07	Standard.	" "
Worthing ...	4 "	28.432	Verified standard.	" "
Sidmouth (Belgrave)...	0.0 "	28.489	" "	" "
Upwey, Dorchester ...	2.40 "	28.135	" "	True minimum
Bodmin	1 "	28.30	Aneroid.	Lowest observed
Guernsey.....	2 "	28.40	Standard.	True minimum

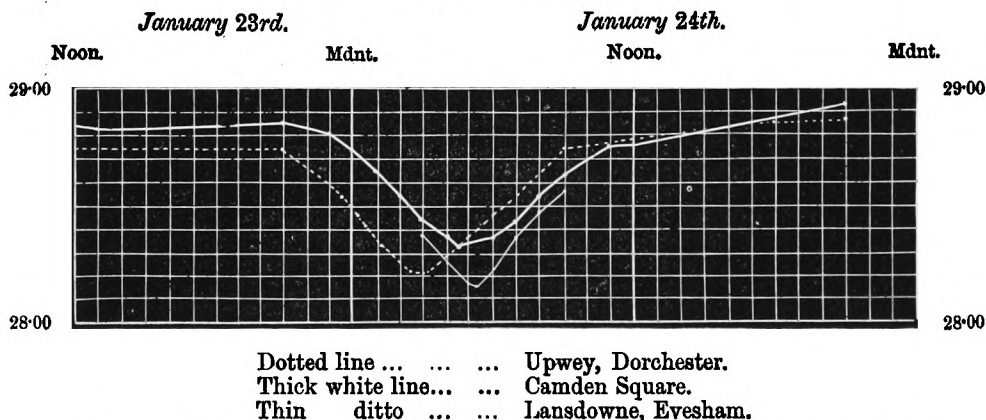
Lowest Reading of Barometer at the Royal Observatory, Greenwich, during thirty years, 1840-1869.

Year.	Date.	Hour.	Reading.	Approximate sea level pressure.	Year.	Date.	Hour.	Reading.	Approximate sea level pressure.
1840	Nov. 13	4.40 p.m.	28.477	28.647	1855	March 22	noon.	28.756	28.926
1841	Oct. 6	10.57 a.m.	28.697	28.867	1856	Sept. 28	10.50 a.m.	28.688	28.858
1842	Oct. 23	11.40 "	28.681	28.851	1857	Oct. 8	3.0 p.m.	28.669	28.839
1843	Jan. 13	0.53 p.m.	28.096	28.266	1858	Nov. 27	3.0 "	28.844	29.014
1844	Feb. 26	2.0 "	28.525	28.695	1859	Dec. 26	6.38 a.m.	28.490	28.660
1845	Dec. 20	6.0 a.m.	28.659	28.829	1860	Jan. 24	1.50 p.m.	28.555	28.725
1846	" 23	8.0 "	28.536	28.706	1861	Nov. 13	9.30 "	28.790	28.960
1847	" 7	2.30 "	28.380	28.550	1862	Oct. 19	9.0 "	28.958	29.128
1848	Feb. 26	9.45 "	28.299	28.469	1863	Nov. 2	9.0 a.m.	28.768	28.938
1849	Jan. 10	noon.	28.829	28.999	1864	Nov. 14	2.20 p.m.	28.606	28.776
1850	Nov. 20	noon.	28.592	28.762	1865	Jan. 14	11.55 a.m.	28.390	28.560
1851	March 23	10.30 a.m.	28.839	29.009	1866	Feb. 11	4.34 p.m.	28.450	28.620
1852	Oct. 27	9.0 "	28.748	28.918	1867	Jan. 8	7.21 a.m.	28.535	28.705
1853	" 19	3.0 p.m.	28.831	29.001	1868	Dec. 24	2.10 p.m.	28.520	28.690
1854	Jan. 7	9.0 "	28.809	28.979	1869	Sept. 12	5.30 a.m.	28.580	28.750

1872, January 24th, 5.20 a.m., 28.21 = 28.38.

The following diagram is based on the observations at three stations where the minimum was accurately observed. It will be noticed that the lowest pressure was at Evesham, and that it also occurred later there than at either of the other stations.

Diagram of Sea Level Pressure.



In conclusion, we are desirous of completing the investigation, first fruits of which are alone sketched above, and we want more data, we care not how fragmentary; even the ordinary 9 a.m. readings on the 23rd and 24th will be useful—afternoon and night observations still more so, and hourly observations, or the records of self-recording instruments during those two days most valuable of all. Details as to the form of instrument and the corrections applied, should be sent with every return.

LUNAR INFLUENCE ON THE BAROMETER.

To the Editor of the Meteorological Magazine.

SIR,—During the autumn and winter (say, during the period from Oct. to March, inclusive) a considerable barometric depression, almost always occurs when the moon reaches full north declination between 4 and 5 p.m., Greenwich mean time. Since 1833, this rule has proved correct, eleven times in twelve. How far it was verified before that date it seems impossible to say, the lunar tables in the *Nautical Almanack* being (up to 1833) too limited to admit of the investigation being carried further back. In the following table *all* the instances that have occurred during nearly 40 years are given. And your readers can judge whether the very frequent apparent connexion of the low barometric readings with the moon's position in declination, ought to be ascribed to a mere coincidence. I should here state that, as the Greenwich mean daily value for the 23rd January, 1842, does not appear to have been recorded, I have substituted the barometric reading taken on that day at 9 a.m. at the apartments of the Royal Society. I may also state that from 1834 to 1841, inclusive, there was no instance of the moon's reaching full north declination between 4 and 5 p.m., during the period referred to in the following table:—

All the instances since 1833 of the moon's reaching full north declination between 4 and 5 p.m. in the period from October to March.	Greenwich mean reading of the barometer on the days in question.	Difference of mean reading from average of 24 years.
	inches.	inches.
23rd Jan., 1842, 4.15 p.m.	29.240 ?	—0.540 ?
13th ,, 1843, 4.45 ,,	28.460	—1.350
25th March, 1844, 4.25 ,,	29.460	—0.250
4th Nov., 1849, 4.45 ,,	29.027	—0.773
6th Dec., 1854, 4.45 ,,	29.415	—0.322
25th March, 1855, 4.36 ,,	29.391	—0.316
2nd Oct., 1855, 4.10 ,,	29.520	—0.240
12th Dec., 1856, 4.15 ,,	29.067	—0.785
19th Feb., 1861, 4.15 ,,	29.523	—0.271
8th Oct., 1868, 4.45 ,,	30.024	+0.349
29th Dec., 1868, 4.20 ,,	29.061	—0.734
23rd Jan., 1872, 4.48 ,,	28.719	—1.061

The greatest barometric depressions at Greenwich (since 1833) were on the 13th January, 1843, and a few hours after midnight of the 23rd January, 1872, both of which dates occur in the above table. It will, however, be seen that the converse of the rule does not invariably hold good, for, although we almost always have a low reading of the barometer when full north declination of the moon occurs, at a time in accordance with the rule, we sometimes have a low reading without that accordance.—I am, &c.

GEORGE D. BRUMHAM.

Barnsbury, February 9th, 1872.

JANUARY, 1872.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 91 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	inches.	in.								In shade	On grass
I.	Camden Town	3.46	+ 1.51	.47	6	22	52.8	31	27.4	13	5	12	
II.	Maidstone (Linton Park).....	4.68	+ 2.62	.78	24	26	54.0	31	23.0	10	10	...	
III.	Selborne (The Wakes).....	7.87	+ 4.60	.98	17	24	49.5	13	23.5	15	8	15	
IV.	Hitchen	3.74	+ 1.60	.65	23	25	50.0	4, 31	26.0	14	10	...	
V.	Banbury	4.27	+ 2.18	.67	23	24	52.0	31	25.5	15	14	...	
VI.	Bury St. Edmunds (Culford).....	2.83	+ .96	.58	23	18	51.0	4*	25.0	14	8	18	
VII.	Bridport	5.92	+ 2.73	.72	4	24	53.0	4	26.0	15	9	...	
VIII.	Barnstaple.....	6.59	+ 3.07	.77	23	28	54.0	13†	31.0	21	...	...
IX.	Bodmin	10.18	+ 4.99	.98	4	28	53.0	13	29.0	20	2	8	
X.	Cirencester	5.04	+ 2.04	.67	23	23	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall)	4.63	+ 2.73	1.14	23	20	53.0	30	24.0	15	19	...	
XII.	Tenbury (Orleton)	5.49	+ 2.96	1.20	23	25	54.5	31	25.5	15	9	14	
XIII.	Leicester (Wigston)	3.43	+ 1.45	.78	24	20	52.0	31	26.0	14	...	...
XIV.	Boston	2.78	+ 1.07	.47	23	21	52.0	30	30.0	9†	7	15	
XV.	Grimsby (Killingholme)	3.34	...	.48	23	23	53.0	30	29.0	4	4	...	
XVI.	Derby.....	3.72	+ 1.93	.68	23	25	54.0	30‡	28.0	10§	8	...	
XVII.	Manchester	4.26	+ 1.74	.42	2	22	51.0	17	24.0	13	11	18	
XVIII.	York	2.89	+ 1.31	.48	3	17	58.0	30	24.0	10	10	...	
XIX.	Skipton (Arncliffe)	9.18	+ 3.54	1.40	4	24	...	...	...	...	...	...
XX.	North Shields	2.78	+ .67	.44	24	21	56.0	30	28.2	21	11	13	
XXI.	Borrowdale (Seathwaite).....	32.14	+ 15.78	5.82	17	27	...	...	...	...	...	...
XXII.	Cardiff (Ely).....	7.51	+ 3.77	1.03	24	25	...	...	...	...	...	...
XXIII.	Haverfordwest	8.90	+ 3.85	1.10	17	25	53.0	28	26.0	19	4	4	
XXIV.	Rhayader (Cefnfaes).....	7.51	+ 2.99	.90	4	22	54.0	...	26.0	...	...	...
XXV.	Llandudno.....	3.33	+ .79	.52	4	20	56.6	29	33.5	22	0	...	
XXVI.	Dumfries	6.35	+ 1.75	.96	10	26	53.0	30	25.0	10||	8	...	
XXVII.	Hawick (Silverbut Hall)	3.97	...	.57	17	23	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House)	7.93	+ 3.41	1.12	16	24	53.0	30	25.0	10	11	20	
XXIX.	Castle Toward .....	...	...	...	...	...	...	...	...	...	...	...
XXX.	Leven (Nookton)	4.15	+ 1.28	.59	5	19	51.0	30‡	25.0	8	12	21	
XXXI.	Stirling (Deanston)	5.53	+ .81	.64	13	27	52.5	31	23.0	9	10	17	
XXXII.	Logierait	4.23	...	.68	23	20	...	...	...	...	...	...
XXXIII.	Ballater	5.86	...	1.35	23	14	50.5	31	22.0	10**	16	...	
XXXIV.	Aberdeen	3.09	...	.32	24	21	50.3	30	29.8	22	4	22	
XXXV.	Inverness (Culloden) .....	...	...	...	...	...	...	...	...	...	...	...
XXXVI.	Portree	14.31	+ 1.22	1.89	31	26	...	...	...	...	...	...
XXXVII.	Loch Broom	5.90	...	.80	26	26	...	...	...	...	...	...
XXXVIII.	Helmsdale	3.02	...	1.23	13	20	...	...	...	...	...	...
XXXIX.	Sandwick	4.44	+ .52	.74	13	28	49.6	30	30.8	10	3	15	
XL.	Cork	7.26	...	.97	31	25	...	...	...	...	...	...
XLI.	Waterford	6.94	+ 2.08	.91	31	24	52.0	31	28.0	21	7	...	
XLII.	Killaloe	6.44	+ 1.58	1.08	24	26	54.5	12	25.0	21	14	22	
XLIII.	Portarlington	2.63	+ 1.38	.26	6	29	52.5	13	25.5	20	14	...	
XLIV.	Monkstown	3.45	+ .06	.79	4	22	58.5	30	22.5	21	10	12	
XLV.	Galway	6.63	...	.92	31	29	54.0	30	26.0	21	2	...	
XLVI.	Bunninadden (Doo Castle)	6.44	...	.74	28	...	51.0	13	23.0	21	6	...	
XLVII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	4.09	...	.36	28	22	54.0	31	26.0	21¶	17	25	
XLIX.	Strabane (Leckpatrick)	6.06	...	.65	28	28	...	...	...	...	...	...

* And 30, 31. † And 14, 30, 31. ‡ And 31. § And 15. || And 21. ** And 22. ¶ And 27.

+ 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.

LINTON PARK.—A mild but wet month; high winds on 4th, 5th, and 24th; fogs frequent; T and L on 6th and 24th; a little S on the 9th only. Winds mostly S. and W., bar. very unsteady, and remarkably low on the 24th, being 28·03 at 7 a.m., and only 28·33 at noon, when we had loud T with heavy rainfall the preceding day and night, amounting to 1·24 in. Very little sunshine the whole month till the 31st, which was fine and bright throughout. A high flood followed the rain of the 24th, higher than on any occasion during the last five years.

SELBORNE.—The wettest month in the last ten years, excepting October, 1865, and December, 1868. Violent wind and aurora on 4th and 5th; H on 4th; H, R, and S at noon on 6th; a few flakes of S in early morning of 9th. White frost on six mornings, fog on five days; tempestuous on night of 23rd and morning of 24th. Bar. lower than for several years; H, T, and L at noon on 24th; wonderful sunset on 26th.

BANBURY.—Remarkable for high winds. T, L, and H at 7·15 p.m. on 5th; high wind on 3rd, 4th, 7th, 10th, 16th, 17th, 22nd, and 23rd.

CULFORD.—As regards temperature this has been a month of very mild weather, the mean being 39°·8. S has not fallen during the month, and the lowest temp. was 25° on the night of the 14th. A fearful TS occurred soon after 1 p.m. on Saturday, the 6th, preceded by a period of almost total darkness, so much so as to render gas-light necessary. A dreadful gale was also experienced on the 23rd and 24th, uprooting trees and doing much damage. Easterly winds during 10 days, and westerly on 21.

BRIDPORT.—Very heavy S.W. gales on 1st, 4th, 23rd and 24th; large lunar halo on 20th. The fall of rain is the heaviest I have registered in January (in 15 years), and in that period has only been exceeded four times, viz., October, 1863, October, 1865, September, 1866, and December, 1868. Heavy floods at 5 a.m. on 24th. Violets, crocuses, and snowdrops well out in the garden before the end of the month, and primroses in the hedges. L on 3rd; T on 5th.

BODMIN.—Average bar. 29·62, average temp. 43°·5. The rainfall (10·18) is the largest but one I have ever registered in one month during 23 years.

ORLETON.—The wettest month of January recorded in 41 years; during that period 4·00 in. of R never fell in the month till 1869, when 4·525 in. fell. Great fall of R and S in the night of 23rd and 24th, causing high floods upon the brooks and rivers. Temp. very variable, but generally warm; average of the month about 3°·5 above the mean. T and L on 4th and 5th; fogs frequent; violent wind on 4th and 17th.

WIGSTON.—The rainfall much above the mean of the month, and the humidity of the air altogether remarkable. The mean temp. also considerably above that of January, which has stimulated vegetation unseasonably.

GRIMSBY.—The month very wet and mild, with many southerly gales. Much sickness prevalent. The ground too saturated to allow of any garden-work being done. Thrush first heard on 12th, blackbird warbling on 30th, aconites in flower on 26th.

MANCHESTER.—T and L early on 4th; large lunar halo at 11 p.m. on 23rd.

YORK.—Lunar halos on 15th and 19th; fog on 20th and 21st.

ARNcliffe.—Violent TS at 5 p.m. on 18th.

SEATHWAITE.—S on the tops of the hills on 3rd, 15th, and 20th; H, T, or L on every day during the first week.

WALE S.

CEFNFAES, RHAYADER.—The month has been unusually rainy and damp; high winds from S.W. on 1st, 17th, and 24th.; T and L occasionally; rivers high and full, but not to flood; great losses of sheep from the constant and continued rains. Snowdrops in fine flower, also crocuses, violets, and daisies.

SCOTLAND.

DUMFRIES.—Only five days during the month on which no rain fell ; weather extremely variable ; frost, E , and violent gales in the course of a few hours ; S on the 4th, 5th, and 7th. Rainfall 3·77 in. above that of corresponding month of last year. The temp. at night was $8^{\circ}\cdot 1$ higher, and the mean of the month $5^{\circ}\cdot 8$ higher (? than January, 1871). Snowdrops in flower on 21st, and at the end of the month the missal, thrush, and blackbird were singing.

SILVERBUT HALL.—A very wet and windy month.

AUCHENDRANE.—Compared with January, 1871, the lazy elements have been well scourged this January, with persistent equatorial winds moving northwards, generally at a rapid rate, and frequently with the force of gales. The mean temp. of the month is more than 2° above our January mean ; the atmosphere has been vapour-laden, with the high mean humidity of 92° ; the rainfall very large—the evaporation small. Estimating the mean temp. of day and night separately, the former is $45^{\circ}\cdot 6$, and the latter $35^{\circ}\cdot 7$. The result of such temp. movements is found in the low bar., and in the limited range of low pressure. The month began and ended with violent equatorial gales. Our heaviest gale was on the 17th and 18th, with heavy rain, with a bar. at 28·35. During the great gale in the S . on the 24th, there was a calm here, with only 0·020 of rain. With a rainfall of nearly 8 in. the river has been in constant high flood, particularly during the week 14th to 20th. It is feared that the trees may have suffered severely.

DEANSTON.—Only five dry days during the month. Gale of wind commenced on evening of 31st.

LOGIERAIT.—A rainy month, with some mild days ; as far as the winter has gone it has been remarkably open. Snowdrops in flower on 31st. A very severe gale on the night of the 31st.

BALLATER.—Remarkably open month ; occasional sharp frosts, though, in general, mild for the season ; no snow, but an excess of rainfall.

ABERDEEN.—A month of dull, mild, damp weather, with frequent gales, heavy hoar frosts, and no S .

PORTREE.—The month has been wet and stormy throughout. T and L on 2nd, with heavy gale at night, and H showers ; gale from S . on 31st. Ground covered with S on 3rd, 4th, 5th, and 6th.

LOCHBROOM.—Wonderfully open month, very little frost, no snow, every day damp and rainy but five ; it was, on the whole, a fine January, though for slush and wind it was remarkable.

IRELAND.

MONKSTOWN.—A large number of days with some rain, though with one or two exceptions, the quantities were small. Temp. low, mean $39^{\circ}\cdot 4$; dense fog on 21st, which was scarcely perceptible at Bray. S on 5th.

DOO CASTLE.—A wet cold month ; no farming operations, the ground is so saturated with rain.

WARINGSTOWN.—Heavy rainfall, many stormy wet days, with lovely pets between.

LECKPATRICK.—Very wet month ; little frost. Primroses in flower on the banks in the last week. More rain this month than in any January this last ten years, except in 1866 ($7^{\circ}\cdot 34$).

ON THE RAINFALL OF JANUARY.

THE total fall (as will be seen by the table on page 14) was above the average at almost every station, and there are several cases in which twice the usual amount fell. At Pen-y-gwyrd, near Snowdon, the amount reached 37·50, and as Seathwaite had 32·14, the fall on the Styne must have been nearly, or quite, equal to that at Pen-y-gwyrd.

DECREASE OF RAINFALL WITH ELEVATION.

To the Editor of the Meteorological Magazine.

SIR,—May I ask the favour of a small space in your next number, to remark with reference to a paragraph on page 231, that I do *not* hold as a fact, “that the horizontal distances of drops of rain at all elevations of a shower are equal,” a statement of which the correctness can probably alone be tested by observations from a balloon: the clause quoted had reference only to the horizontal distances of the drops, in showers of like density, *as they fall into the gauge*, at different angles with the vertical, no allusion being made to the drops at *different elevations* from the ground.—Yours truly,

G. WARREN.

Merton Villa, Cambridge, Jan. 18, 1872.

To the Editor of the Meteorological Magazine.

SIR,—If Mr. Franklen Evans can adduce any instance in which a gauge perched on the very top of an isolated hill catches more than a similar gauge in the plain below, I shall be glad to hear of it. The instance I gave of Ling Hill is to the point. The gauge on the top (315 ft.) caught in 1870 23·95 in., whereas one in the level garden of the lighthouse (198 ft.) caught 26·63 in., and another gauge on level ground at Whitby, at about the same elevation, caught 26·08 in., although insufficiently exposed. The latter was more than a mile distant, and quite “out of the attraction” of so small and isolated a hill. How far attraction causes rainfall is another question.

I believe also that he will find that in balloon ascents moisture has been found to increase up to what I may call the cloud-strata, and to diminish rapidly beyond that, and that I am perfectly correct in my statement. For the increase of moisture observed during an ascent of Snowdon, I can refer him to Vol. IV. of the “Proceedings of the Meteorological Society.” p. 272.—I am, Sir, your obedient servant,

FENWICK W. STOW.

P.S.—I need hardly explain that in my recent letters I have not used the word “diverge” in its strict mathematical sense. As my definition of it involves a supposition of momentary parallelism, I would substitute for it “an increase in the shortest distance between the paths of the drops.”

To the Editor of the Meteorological Magazine.

SIR,—Will you allow me to say, that however acute and accurate the calculations of your correspondents may be on this subject, and however valuable their figures and diagrams may be to science, their calculations are of little use to ordinary thinkers if their data are wrong. I find that the same process of rainfall takes place here as in India, and as no two clouds are of the same density, or of the same equality in moisture, and as no two rainfalls take place under exactly similar conditions of wind, so no diagram can convey a correct impression of the subject. On Monday last I left my house at 10 a.m., for Henley-on-Thames, distant four miles, and about 400 feet below me.

As we started there was a haze, which I called a cloud ; as we drove on, we became sensible of a cold moisture striking our faces, though there was no wind ; the sensation was due to our own motion (seven miles an hour), and showed that the moisture was stationary. The cloud extended above us, perhaps 300 feet ; we could see the glare of the sun through it, an occasional bit of blue sky, and a stratum of fleecy clouds far above us. We gradually got down into rain, and my conclusions were, that at 400 feet above the valley there was imperceptible moisture, ; at 300 feet the moisture was felt, but not seen ; at 200 feet it was a visible wet mist driving with a very gentle breeze ; at 100 feet we reached a drizzle ; and on the Henley level it was rain, with a little more wind, and no mist, but the glare of the sun could not be seen. The thickness of the cloud that we passed through in about 20 minutes, was a little over 300 feet, and the total thickness about 600 feet ; it moved with the wind below, but no motion could be detected above. A gauge at 50 feet of elevation above the level of the valley would have registered nothing, the umbrella scarcely showed the effects of the drizzle, but directly we got on the level I had to avoid the dripping as I drove. I have no doubt but this cumulative process may come under the head of "*Electric Polarization*," as there is electricity in the rain-drops, and in the earth ; but as the condition of the latter is perpetually changing, and as the moisture of the atmosphere varies constantly, I do not think that the latter by itself is a "regulator of rainfall," as Mr. Hugh Ingram supposes, but I have long considered that the atmosphere and earth combined regulate and arrange the rainfall phenomena.—I am, yours faithfully,

H. P. MALET.

Nettlebed, Jan. 25th, 1872.

To the Editor of the Meteorological Magazine.

SIR,—A simple experiment will decide the truth of Mr. Malet's theory in your December number.

In a letter to me he writes, "The gauge on the hill top fills more than that on the level, because the hill top condenses more clouds ; but if a gauge on the hill top were placed as high for it as the gauge on the pole, the relative quantities of the two elevated gauges would be the same."

Will not some of our rainfall registrars put this statement to the proof?—Your obedient servant,

F. R. HAWKES-MASON.

Wreham, Norfolk.

To the Editor of the Meteorological Magazine.

SIR,—On page 231 Mr. Cator says that "the point in dispute hinges on the question whether the horizontal distance between rain-drops is the same at all heights." I agree with him entirely ; and now I ask, what can possibly alter the horizontal distances of the rain-drops ? They are subject to no horizontal force but that of the wind ; I suppose no one is going to deny the second law of motion, and maintain that

the force of gravity can have anything to do with horizontal distances. Since, then, they are subject to the force of the wind alone, if at some height, it blows hard, all the drops are driven through a considerable horizontal space, but all the drops at that height are driven through the *same* horizontal space, and if, when they come to a lower level, it blows less hard, they are driven through a smaller space, but they are all driven through the *same* space: the wind has no predilection for one drop over another, it treats them all with perfect impartiality. It follows, therefore, that their relative horizontal distances must always remain the same, whatever the height through which they have fallen, and whatever may be the variations in the force of the wind; and, therefore, as Mr. Cator says, "*cadet quæstio*."—Yours truly,

J. M. DUPORT.

Mattishall, Feb. 9th, 1872.

DEW POINT AND OTHER HYGROMETERS.

To the Editor of the Meteorological Magazine.

SIR,—I freely accept Mr. Dines' amendment in the wording of my first proposition (p. 191), though I think its meaning (in connexion with Nos. 2 and 3), could not be misunderstood.

A complete *limit* to evaporation, no doubt, exists "when any liquid is at the same temperature as the superincumbent atmosphere, and the elasticity of liquid's vapour in the air is its 'maximum tension' for that temperature." But this limit to evaporation does *not* exist (as I believe Mr. Dines thinks), when the temperature of the air is *higher* than that of the liquid, although the elasticity of the vapour existing in the air be equal to (or even somewhat greater than) the maximum elasticity at the temperature of the liquid.

The facts, in the case of the wet bulb thermometer appear to me to afford a complete refutation of what I conceive to be Mr. Dines' opinion.

Thus taking his own experiment, to which I referred (Nov. 1871, p. 167), let us suppose dry bulb at 59° Faht.; wet bulb at 53°·8; I consider 49°·69 as the dewpoint, and let us suppose water to be present at this latter temperature: although the air (at 59°) contains vapour at the maximum density corresponding to 49°·69; yet (*unless* the atmospheric temperature should fall *altogether* to this temperature) it still retains—from its surplus heat—the power of taking up vapour from the liquid, not only when the latter is at 49°·69, but several degrees below it. That this is the case is proved most distinctly, in my mind, by the experiment here referred to.

Mr. Dines' experiments, I consider of the greatest interest as regards this one point, viz.:—"At what temperature of water, below the dew-point, does condensation cease, and evaporation commence?" This, I am certain, is a *fixed temperature*, whenever wet and dry bulbs are respectively at any given temperatures, with the same atmospheric pressure.

The tables I have made for calculating the dewpoint from the indications of the dry and wet thermometers enable me to *infer* the tem-

perature of water at which this event should occur. But a collection of accurate "experimental temperatures" I should look on as a great boon to science, as well as a valuable check on my own calculations of the dewpoint.

The "amount of evaporation" depends on so many circumstances (viz., on temperature and dryness of air, the velocity of its currents, the temperature, extent of surface, and quantity of liquid, &c.) that I think little progress can be made with regard to its laws without a *separate* investigation of the influence of each circumstance, and I attach the greatest interest to Mr. Dines' researches into the "initial temperature of evaporation from water acted on by air at a given temperature and degree of humidity." If he could furnish to your magazine a table with the following particulars, I feel convinced it would be received by all meteorologists as a treasure:—Yours faithfully,

HENRY HUDSON, M.D., M.R.I.A.

Temp. of Dry Bulb.	Temp. of Wet Bulb.	Temp. of Water when evaporation commenced.	Height of Barometer.

DISCORDANT MAXIMUM TEMPERATURES.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Mackenzie's difficulty in connection with the discordant readings of his two maximum thermometers, admits of a very simple explanation.

It is a well-known fact that, *cæteris paribus*, the smaller the bulb of a thermometer the greater is its sensitiveness to slight variations of temperature.

Hence, the thermometer marked B, having the smaller bulb of the two, would naturally outstrip A whenever a sudden rise of temperature occurred, and if the rise of temperature were very transient,—the result, for instance, of a temporary lull of the wind, or of a momentary gleam of sunshine—would seize and register the increase of temperature before its more sluggish companion had had time to rise to the occasion.

This being the case, the results of the readings of the two thermometers are just what might have been expected, and Mr. Mackenzie may congratulate himself on their perfectly consistent performance, as shown in the table which he appends to his letter.

It is scarcely necessary to add, that the reading given by B should be adopted in preference to that of A, as being, if not the absolute maximum, at any rate the nearer of the two.

For the rest, until that uniformity in the instruments and methods of observation, which the *Meteorological Magazine* has so consistently advocated, is realized, discrepancies of this nature are unavoidable, and we should have great reason to congratulate ourselves if there were none more serious than those indicated by Mr. Mackenzie.

Yours faithfully,

GEORGE T. RYVES.

Buildwas, Salop, Feb. 7th, 1872.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

LXXIV.]

MARCH, 1872.

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ANOTHER METEOROLOGICAL CONFERENCE.

WE fear that this title will lead some of our readers to exclaim :—
“ We did not know that a Meteorological Conference had ever been proposed much less carried into effect.” As information respecting the former one is not generally accessible, we commence that which we think will prove a long series of articles, by particulars respecting the Brussels Conference of August, 1853.

Maritime Conference held at Brussels, for Devising a Uniform System of Meteorological Observations at Sea ; August and September, 1853.

The Governments represented at the Conference, and the names of the officers who attended, were :—

BELGIUM—by A. Quetelet, directeur de l'Observatoire royal, secrétaire perpétuel de l'Académie royale des sciences, des lettres, et des beaux-arts de Belgique ; and Victor Lahure, capitaine de vaisseau, directeur général de la marine ;

DENMARK—by P. Rothe, Captain-Lieutenant Royal Navy, Director of the Depot of Marine Charts ;

FRANCE—by A. Delamarche, Ingénieur hydrographe de la marine impériale ;

GREAT BRITAIN—by F. W. Beechey, Captain, R.N., F.R.S., &c., Member of the Naval Department of the Board of Trade ; and Henry James, Captain, R.E., F.R.S., M.R.I.A., F.G.S., &c. ;

NETHERLANDS—by M. H. Jansen, Lieutenant Royal Navy ;

NORWAY—by Nils Ihlen, Lieutenant Royal Navy ;

PORTUGAL—by J. de Mattos Corrêa, Captain-Lieutenant Royal Navy ;

RUSSIA—by Alexis Gorkovenko, Captain-Lieutenant Imperial Navy ;

SWEDEN—by Carl Anton Petersson, First Lieutenant Royal Navy ;

UNITED STATES—by M. F. Maury, LL.D., Lieutenant United States Navy.

THE CONFERENCE.

The proceedings of the first meeting commenced at the residence of the Minister of the Interior, on the 23rd of August, 1853, at half-past eleven in the morning.

The attention of the meeting was first directed to the choice of a president. Lieutenant Maury was requested to direct the proceedings, but he declined the honour ; and, at his suggestion, in which other members of the meeting concurred, Mr. Quetelet took the chair.

The President submitted to the meeting the propriety of publishing the discussions of the Conference ; expressing, as his opinion, that publicity was one of the best methods of insuring the success of their undertaking ; remarking, at the same time, that, independently of the information which would be conveyed to the public through the medium of the press, the minutes of each sitting and the scientific report of the Conference would thus be preserved.

Lieutenants Jansen and Maury seconded the motion.

The President next called upon Lieutenant Maury to explain to the meeting the object of his mission.

Mr. Maury spoke as follows :—

"Gentlemen,—The proposal which induced the American Government to invite the present meeting originated with the English Government, and arose from the communication of a project prepared by Captain Henry James, of the corps of Royal Engineers, by order of General Sir John Burgoyne, Inspector-General of Fortifications, in which the United States Government was invited to co-operate.

"Nineteen stations have been formed by the English authorities upon a uniform system, and the direction of the observations confided to the immediate supervision of the officers in command of the respective stations.

"In the United States meteorological observations had been made since the year 1816.

"The American Government sympathized with the proposal of the English Government, but said : Include the sea, and make the plan universal, and we will go for it. I was then directed to place myself in communication with the ship-owners and commanders of the navy and mercantile marine, in furtherance of the plan.

"It is from the information extracted from more than a thousand logs that I have been able to prepare the Charts which have been published up to this time, showing the sailing routes and the direction of the winds and currents.

"With a view, however, of extending still further these nautical observations, the Government of the United States decided upon bringing the subject under the consideration of every maritime nation, with the hope of inducing all to adopt a uniform model log book.

"In order to place the captains navigating under a foreign flag in a position to co-operate in this undertaking, Mr. Dobbin, Secretary of the Marine Department at Washington, has instructed me to make known that the mercantile marine of all friendly powers may, with respect to the Charts of the Winds and Currents, be placed on the same footing as those of the American Marine ; that is to say, that every captain, without distinction of flag, who will engage to keep his log during the voyage upon a plan laid down, and afterwards communicate the same to the American Government, shall receive, gratis, the Sailing Directions and the Charts published.

"It has consequently been suggested to the captains, that they should provide themselves with *at least* one good chronometer, one good sextant, two good compasses, one marine barometer, and three thermometers for air and water. I make use of the expression *at least*, because the above is the smallest number of instruments with which a captain can fulfil the engagement he contracts upon receiving the Charts.

"Foreign flags will thus enjoy the advantage of profiting at once by all the information collected up to this time.

"You will not fail to observe, gentlemen, that the observations made on board of merchant vessels, with instruments frequently inexact, are not to be relied upon in the same degree as those made where the instruments are more numerous and more delicate, and the observers more in the habit of observing.

"The former, however, from the fact of their being more numerous, give an average result, which may be consulted with advantage ; but the observations made on board the ships of the navy, although fewer in number, are evidently superior in point of precision.

"The object of our meeting, then, gentlemen, is to agree upon a uniform mode of making nautical and meteorological observations on board vessels of war. I am already indebted to the kindness of one of the members present, Lieutenant Jansen, of the Dutch Navy, for the extract of a log kept on board a Dutch ship of war, and which may be quoted as an example of what may be expected from skilful and carefully conducted observations. In order to regulate the distribution of the Charts, which the American Government offers gratuitously to captains, it would in my opinion be desirable that, in each country, a person should be appointed by the government to collect and classify the abstracts of the logs of

which I have spoken, through whom also the Charts should be supplied to the parties desirous of obtaining them."

A unanimous vote of thanks was passed to Mr. Maury.

The Conference lasted until September 8th, and brought forward a mass of suggestions and good ideas, which rendered the year 1853 a memorable date in meteorology. But twenty years have nearly elapsed and we must not devote to the past, however interesting, that detailed notice which belongs to the present.

The necessity for another conference has been for some time recognized by leading meteorologists, but the first to give expression and definition to the proposal, is no less a man than Dr. Buijs Ballot, in his remarkable pamphlet, "Suggestions on a Uniform System of Meteorological Observations," which, on receipt, we felt to be one so emphatically deserving of notice by British meteorologists, that we immediately telegraphed to Utrecht, to ask the Doctor to send over a supply of copies, that we might place them in the hands of our publisher, and thus render them accessible to any person in the British Isles, on the very economical terms stated on our cover, which sufficiently indicate the generosity of the author. On the present occasion, and for probably the only time, we quote from it, viz., the preface, but in future numbers we shall assume that our readers have secured copies for themselves.

"In the following pages I have endeavoured to review some of the questions that may be discussed at a meeting of the General Congress of Meteorologists to be held, probably at Vienna, in the course of the present year.

"The want of such a Congress is deeply felt, and whenever it meet, it will be of great utility. Nor can it be but a saving of much time, if attention be previously directed, however imperfectly, to such subjects as are likely to be submitted to consideration.

"In this paper I have adverted only incidentally to foreign inquiries, the great scientific value of which I am eager to acknowledge.

"An apology is perhaps due for this apparent neglect.

"M. Mühry's inquiry into the local influence of mountains, of rain and wind, and the investigations of the progress of storms by Messrs. Buchan, Dove, Clement Ley, Loomis, Moon, Le Verrier, and especially of the origin of depression systems, the great problem to be solved, have engaged my most serious attention. I should have dwelt at some length on Mr. Clement Ley's work, "The Laws of the Winds prevailing in Europe," in which the writer agrees on many important points with Prof. Mohn, but unfortunately his publication did not reach me until the following pages had been printed.

"My principal aim, however, has been to draw attention to the general method of observing, and of printing the facts observed at the least expense and so as to facilitate particular investigations.

"I entreat the reader's indulgence if I appear to insist too much on such instructions as I have observed myself, or dwell too long on researches made by the Dutch Meteorological Institute. I should be sorry if this were imputed to my not sufficiently appreciating the investigations and labours of others.

"Zealously as I have advocated my opinion, I am most anxious to do ample justice to those distinguished philosophers, my fellow-labourers, and shall pay due deference to their opinions by eagerly complying with such of their wishes as may be generally accepted by the Congress.

"The Dutch language is seldom known beyond the confines of our own country, and this circumstance, joined to the imperfect character of our researches, has caused them to be taken little notice of.

"Hence I have deemed it advisable to have recourse to another medium.

"While in German more general questions have been discussed, the English language is perhaps more widely known, I have therefore selected it for this communication. This will sufficiently account for the many imperfections in the style of this paper. Yet sensible as I am of never having attained that clearness and propriety of diction, so characteristic of English writers, I hope I have succeeded everywhere in making myself intelligible to those to whom these pages are more specially addressed.

"*Utrecht, 10 January, 1872.*

BUIJS BALLOT."

WEATHER MAPS.

IN these pages we have always announced our honest and unbiassed opinion without fear or favour, hence last year the strong way in which we argued as to the incumbent duty which lay upon the Meteorological Committee, as the only national body solely devoted to Meteorology, to take up the matter of Weather Maps, and place us abreast of other nations, who, copying our system, had carried it on to such perfection that we were being left disgracefully in the rear. We do not for a moment claim that our article has quickened their proceedings, but we have infinite pleasure in laying the following circular before our readers:—

*Meteorological Office, 116, Victoria Street, S.W.,
11th March, 1872.*

SIR,—I am instructed to inform you that the Meteorological Committee propose to issue Lithographed Charts illustrative of the Daily Weather Report.

Such charts can be delivered in London, within a reasonable distance from the office of the printer (in Lincoln's Inn Fields), between one and two o'clock p.m., or posted in time for the evening despatch to the country.

(The charts for Sundays cannot be delivered before Tuesday morning, as the Office is closed on Sunday.)

The cost of delivery of the charts by hand, and of postage, will entail some outlay, which it will be necessary for the recipients of the charts to defray.

These charges it is proposed to meet by a subscription, payable in advance, of—

Ten shillings per quarter for a copy to be delivered by hand before two o'clock p.m.

Five shillings per quarter for a copy sent by book post.

The charts will be sent gratuitously until the 31st of March.

If you should wish to receive them after that date, you will please to let me know, stating the number of copies you will require. The subscription will cover any reasonable number of copies.

The Committee reserve to themselves the right of declining to supply copies by hand on the ground of distance.

Your obedient servant,

ROBERT H. SCOTT,

DIRECTOR.

We regret that we cannot also reproduce the table and charts which accompanied it, but we have no doubt whatever that Mr. Scott will gladly send a few specimens to all who will address to him an intimation of their desire to judge for themselves. We think that it would be unfair to look upon the first few numbers as indicative of the delicacy of manipulation of which the plan adopted is capable, but we are certainly at present favourably impressed with its clearness; at the same time we may throw out a few hints for consideration:—1st. General: would it not be well to mark on the outline sketch of Europe by small white discs the approximate sites of the Committee's stations; this, if once done, would occasion neither further trouble nor cost, and those not in the office are seldom acquainted with the position of, say Greencastle and Farö. 2nd. As to Barometer—we are glad to see the isobars so plainly figured, but we hope that occasionally a few more of the actual readings may be inserted. 3rd. As to temperature—we would make the same remarks, supplemented by expression of our hope that if it is even suspected that any of the stations report temperatures normally either too high or too low, some intimation of that fact should be made to the subscribers; for instance, we do not know precisely where the thermometers are placed at Plymouth. But is it not evident that, leaving out of question altogether different forms of thermometer-stand, a very different temperature must prevail in the lower part of the town and on Mount Wise, and which is the fairer representative of the temperature sweeping over the sea cliffs of South East Devon, or the weather-beaten tors of Dartmoor; which the more suitable for comparison with their station in the storm-beaten Scilly Isles? We are fully aware that nothing approaching to accuracy is in this respect obtainable, but it would be of great use to know that normally the temperature recorded at Plymouth was, say 3 degrees higher than on Mount Wise, 4 degrees higher than on the Breakwater, and $4\frac{1}{2}$ degrees than at the Eddystone. As to wind and sea cloud, fog, rain, thunder, &c., we also think the arrangements are very good.

And now there is only one point to consider,—the price. We do not see how this could possibly have been less than it is, and we shall be very much surprised if in a few years' time there is a club-house, country news-room, large shipper's office, or large farmer's breakfast-table without a map of the previous day's weather, and which will lie punctually on the table for considerably less than one penny a day.

MINOR UNDULATIONS IN BAROMETRIC DEPRESSIONS.

To the Editor of the Meteorological Magazine.

SIR,—A fact is mentioned in Mr. Maxwell's letter in your last number which I have often noticed, but which does not appear to have attracted the attention of meteorologists. I allude to the minor oscillations exhibited by the barometer during an extended fall.

These oscillations are well exhibited in the curves from the continuously self-recording instruments, and in almost every instance of

a long steady fall the trace exhibits a sinuous appearance, as though a series of minor undulations was superimposed upon the great wave of diminishing atmospheric pressure.

Of course I am not now alluding to the well-known "pumping" or "heaving" the ordinary barometer so frequently exhibits during a gale of wind, and which being due to the gusts, can be seen by the eye when the instrument is closely watched; but the fluctuations in question have a much longer period than the "hevings."

May we not suppose them to be due in some measure to inertia in the atmosphere, for if they are registered, or observations are plotted down in a curve, we get a striking similarity to the trace produced by a magnetic needle undergoing deflection either in the presence of another magnet or under the action of varying terrestrial magnetic forces.

It will be found by experiment with delicate magnets, that a suspended needle when acted upon by another magnet will not be deflected at once to the greatest extent, but will proceed to make a series of vibrations, each alternate swing being extended farther in the direction in which the needle is being deflected, until the position of equilibrium is reached.

I do not say the two phenomena are in any way analogous, but only to remark upon the similarity exhibited in this respect between barograph and magnetograph curves during periods of disturbance.

Yours truly,

G. MATHUS WHIPPLE, B.Sc. (Lond.)

Kew Observatory.

THE BAROMETRIC DEPRESSION OF JANUARY 24, 1872.

To the Editor of the Meteorological Magazine.

SIR,—In your enumeration of recorded cases of barometric depression approaching or equal to the great depression of last January, you appear to have overlooked the depression of 1814, which occurred at the breaking up of the great frost.

You may, of course, have reasons for omitting it as untrustworthy, but I find it given by the late J. H. Belville, of the Greenwich Observatory, whose reputation for accuracy, I believe, stood very high, in his "Manual of the Mercurial and Aneroid Barometers," without any expression of doubt as to its correctness, as 28·21. It will be found in "A Table of the greatest and least observed heights of the barometer for the last thirty-eight years, taken at Greenwich, and reduced to 32° of Fahrenheit," at page 19. I should add that the "Manual" was published in 1849, by Taylor, of Red Lion-court, Fleet-street, and the thirty-eight years referred to comprise the period from 1811 to 1848.—Yours truly,

GEORGE T. RYVES.

Buildwas, Iron Bridge, Salop, March 5th, 1872.

[No, we did not overlook the depression of 1814, and though the letter to which Mr. Ryves refers was compiled and written after a

night spent by the side of the barometer, we are not yet convinced that it contains a single error. Did Mr. Ryves notice the governing clause in the second paragraph on page 10, "the only instances which I can convince myself have exceeded the present are, &c." Now the question is, did the depression of 1814 exceed that of 1872? on the evidence before us we thought *not*, but we have not had time to investigate further, and cannot speak positively. The reading quoted by Mr. Ryves is from a table which does not state whether or not the values are corrected for altitude, nor what the altitude was—if at the Royal Observatory, 28·21 would be nearly 28·40 at sea level, or far above our limit, but if taken, as is more probable, in the town of Greenwich, then it might not be more than 28·26 or 28·30, and so be below it. As to the very high reputation for accuracy of the late Mr. Belville we know nothing, but if the frontispiece to his work represents his idea of a standard barometer, and the one he employed we should certainly be very careful in using his results.—Ed.]

To the Editor of the Meteorological Magazine.

SIR,—As requested, I send you my notes of the above (irregular from illness). The readings are all corrected and reduced to sea level; barometer, a standard, 65 ft. above mean sea level.

1872.	in.	
Jan. 22nd, 10 p.m.	29·206 f.	
23rd, 11 a.m.	28·826 f.	
2 p.m.	28·776 f.	} Two readings of a slight rise, marked at the time on the diagram, but not exactly taken.
5 p.m.	28·820 r.	
10 p.m.	28·758 f.	
24th, 4 a.m.	28·432 s.	} This minimum reading is <i>estimated</i> by comparison with readings of a small Aneroid taken at 10 p.m. 23rd, 4 a.m. and 10.15 a.m. 24th. Being less sensitive than the standard, probably the actual min. of the latter was lower.
10.15 a.m.	28·709 r.	
9 p.m.	28·895 r.	
(N.B. Rise of Barometer checked in this interval.)		
25th, 10.30 a.m.	28·931 r.	
10 p.m.	29·022 r.	

I watched the Aneroid by my bedside from 3.50 to 4.30, and again at 5 a.m. on the 24th, and am certain that the minimum pressure did not occur later than 4 a.m. At that time it was very unsteady, the index frequently oscillating ·02 in. as each long-drawn blast blew over. The rainfall here of January has been enormous, viz., in 24 rainy days 7·43 inches, of which there fell 0·56 on 22nd, 1·13 on 23rd, and 0·13 on 24th, just half an-inch more in the three days than fell on the other side of the hills at Worthing.

N.B.—Approximate correct altitude above sea level of rain gauge, is 60 feet.—Yours faithfully,

HUGH INGRAM.

Steving, 22nd February, 1872.

[We have been favoured by several gentlemen with tracings of their

self-recording barographs, and we have received a few notes of readings from ordinary observers, but up to the present time their response to the request at the foot of page 12 is unusually slight. We hope they will notice this, and kindly save us the trouble and cost of individual application.—Ed.]

BAD WEATHER, JANUARY 1ST TO 14TH.

SIR,—The following extracts from my register for the last ten years seem to point to something like periodicity in the storms of the early part of January :—

- 1862, Jan. 11.—High wind and heavy rain.
- 1863, „ 1.—Much rain and high wind in night.
- „ 5.—Barometer at 9 p.m., 28·55 in. (at 32°).
- 1864, „ 7.—(Minimum temp. of year.)
- 1865, „ 12.—High wind ; barometer at 3 p.m., 28·594 in.
- „ 13.—High wind ; rain and snow = 0·46 in.
- „ 14.—Barometer at 9 a.m., 28·106 in.
- 1866, „ 3.—High wind.
- „ 6.—High wind.
- „ 8.—Hail and snow.
- „ 11.—High wind and snow. Barometer very low for several days past.
- 1867, „ 5.—High wind and snow.
- „ 7.—High wind and heavy rain.
- „ 8.—Barometer at 9 a.m., 28·266 in.
- „ 9.—Barometer at 9 a.m., 28·428 in.
- 1868, „ 5.—Snow and sleet.
- „ 6.—Snow and sleet.
- 1869, „ 1.—High wind in night.
- „ 2.—High wind in night.
- „ 4.—High wind in night.
- „ 5.—High wind.
- 1870, „ 6.—High wind in night.
- „ 7.—Very high wind.
- „ 8.—Barometer 28·558 in.
- „ 9.—Barometer 28·85 in.
- 1872, „ 3.—Very high wind in night.
- „ 5.—Barometer at 9 a.m., 28·564 in. ; thunder, lightning, and hail at 7,30 p.m.
- „ 7.—Barometer at 10 p.m., 28·805 in.

Barometer corrected for temperature, but not for height above sea level = 345 feet.—Truly yours,

THOMAS BEESLEY.

5, High-street, Banbury, February 10, 1872.

THE WINTER AND COMING SUMMER.

To the Editor of the Meteorological Magazine.

SIR,—The table that accompanied my letter which appeared in your magazine for December last, showed that the mean temperature of the winter of 1871-72 should, at the very least, be in excess of the average by nearly 1 degree. The table further showed that the mean of the winter would probably be very much more than 1 deg. in excess ; for in six out of ten instances there given, the winter was more than

3 deg. above the average, and in four instances as much as 4 or 5 deg. above the Greenwich average of 100 years. Now the mean temperature of the past winter (reckoning from December to February inclusive), has been $41^{\circ}5$, which is $2^{\circ}9$ above Mr. Glaisher's adopted average of 50 years, and $3^{\circ}5$ above the Greenwich average of 100 years. So the law has again been strikingly verified.

In the letter and table above referred to, I showed that the coming summer would be warmer than the average, and according to another law, which, as far as I can ascertain, has never failed, the coming summer must be hot. In fact the mean temperature of the summer must, on the lowest computation, be considerably in excess of the average.—I am, &c.,

GEORGE D. BRUMHAM.

P.S. The following *errata* occurred in the above-mentioned letter :—At line 11 from the top of page 193, for 1868 read 1867 (Nov. 1867), and at line 8 from the end of the letter (when speaking of extremely hot summers since 1829) for 100 years, read 42 years. The summers of maximum heat in the 68 years preceding 1829 were those of 1826, 1818, and 1778.

[It is only justice to ourselves to remark, that a proof of every letter is sent to the author, and that the above and several similar *errata* pointed out in our pages, are neither our fault nor the printer's. We hope our contributors will take the hint in good part.]—ED.

TRUE TIME.

The receipt of the following letter reminds us that it may be expedient to explain that though the above heading has not recently appeared in our pages, the subject is just as important as ever, and our silence has been caused by the knowledge that the question had been fairly taken up, and was in excellent hands. We may mention that some of our articles having been honoured by transference to the pages of the *Horological Journal*, the discussion has been continued there with considerable ability. The subject has also been discussed in the *English Mechanic*. We understand that Mr. Evans is by no means alone in the race, or in his determination to uphold the honour of his profession, we cannot hope that *all* will win, but are thankful to all who try. As to deciding on respective merits *that* appertains more to our esteemed contemporary, the *Horological Journal*. But so soon as a thoroughly good pattern, at a moderate price, is obtainable, we shall rely upon those of our observers who have not such a time-keeper procuring one as soon as possible. True time gives regularity to observations, and in some cases increases their value at least a thousandfold.—ED.

CHEAP ASTRONOMICAL CLOCKS PRODUCED.

To the Editor of the Meteorological Magazine.

SIR,—In reply to the various articles which have appeared in your journal on cheap astronomical clocks, and being desirous of removing

any slur from our profession, and also willing to render any assistance which may lie in my power to our valuable friends, the astronomers, I have devoted my leisure to drawing the designs, and working out the dimensions, of the various parts of the above clock, have made the different patterns, and put three in hand at once, which I can produce for £12 each. Those who have named £5, cannot have had much experience in constructing such a timekeeper as I consider is required.

I have used the favourite escapement, the double three-legged gravity; considering astronomers desire a sonorous tick also, they have the cheapest kind of compensation pendulum, vibrating seconds, as a matter of course; the rods are of straight-grained deal wood, which I know to be thoroughly free from moisture and well seasoned, happening to have had a gross of them made for me some six years ago; after being well seasoned they have had no less than four coats of good varnish on them. I fit a piece of brass tube outside the diameter of rod for the crutch-pins, to act against; the bob is a turned cylinder of lead and fourteen inches high, resting on its divided regulation nut, and capable of adjustment for mean or sidereal time. Its weight is 15 lbs. The train of wheels for keeping the foregoing pendulum in motion, is pivoted into an ordinary pair of brass plates, firmly fixed to a cast iron platform, screwed to the base and sides of case, having its escapement carried to the back, and as near the pendulum as possible, which of course is hung on a cast iron cock attached to the stout back of case.

The movement carries a 12-inch painted dial plate, with separate circles for the seconds, minutes, and hours; to simplify and reduce friction as much as possible, the hour hand is carried round once in every twelve hours, by a wheel driven by the main wheel, which is larger than usual, in order to carry the weight as far from the pendulum as possible and close to the side of case. I make use of the ordinary maintaining power to keep going whilst winding, and seven and a half turns on the barrel serve for the eight days; the whole is fitted into a plain solid mahogany case, made just long enough to take the pendulum, with full length glass door in front, and door at back to inspect the escapement.

I purpose constructing some zinc and iron compensation pendulums, suited also for these clocks.

JOHN EVANS.

89, Mount-street, Grosvenor-square, W.

FEBRUARY, 1872.

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	inches.	inches.	in.				Deg.	Date.	Deg.	Date.			
II.	Maidstone (Linton Park).....	1.33	— .18	.31	19	18	57.0	10	31.4	28	1	7		
III.	Selborne (The Wakes).....	3.10	+ 1.39	.38	1	21	52.5	10	31.5	9	2	4		
IV.	Hitchen	1.25	— .01	.26	7	23	53.0	24†	29.0	27	3	...		
V.	Banbury	1.88	+ .45	.43	18	17	54.5	10	31.0	17	1	...		
VI.	Bury St. Edmunds (Culford).....	.90	— .52	.32	7	10	55.0	10	24.0	19	6	12		
VII.	Bridport	2.53	+ .47	.36	5	24	55.0	23	29.0	21	2	...		
VIII.	Barnstaple.....	4.64	+ 2.56	.84	22	24	56.5	25	38.0	21||	...	...
IX.	Bodmin	9.59	+ 6.80	1.29	12	25	58.0	29	35.0	16	0	2		
X.	Cirencester	2.87	+ 1.26	1.08	17*	18	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall)	2.89	+ 2.00	.60	6	22	53.0	29	29.0	17	6	...		
XII.	Tenbury (Orleton)	4.14	+ 2.57	.65	6	24	57.0	10	30.5	3	2	7		
XIII.	Leicester (Wigston)	2.05	+ .71	.64	19	20	56.0	10	32.0	16¶	...	...
XIV.	Boston	1.78	+ .57	.37	18	20	...	...	...	...	...	...
XV.	Grimsby (Killingholme)	2.38	...	.49	29	21	55.0	10†	33.0	10	0	...	
XVI.	Derby.....	2.87	+ 1.39	.51	17	22	55.0	10	33.0	17	?	...		
XVII.	Manchester	3.02	+ 1.07	1.08	29	18	56.0	10	33.0	17	0	8		
XVIII.	York	2.50	+ 1.12	.58	24	21	50.0	1	33.5	22	0	...		
XIX.	Skipton (Arncliffe)	7.91	+ 4.24	1.68	29	27	...	...	...	...	...	...
XX.	North Shields	2.39	+ .86	.77	24	23	54.0	1	33.0	8	0	2		
XXI.	Borrowdale (Seathwaite).....	17.53	+ 6.15	2.00	28	21	...	...	...	...	...	...
XXII.	Cardiff (Ely)	4.65	+ 2.58	1.09	23	23	...	...	...	...	...	...
XXIII.	Haverfordwest	6.62	+ 3.76	.84	9	19	52.6	24	30.4	26	2	4		
XXIV.	Rhayader (Cefnfaes).....	5.85	+ 2.87	.90	29	19	53.0	...	32.0	...	...	...
XXV.	Llandudno.....	3.04	+ 1.69	.24	17	17	57.7	5	34.2	28	...	...
XXVI.	Dumfries	5.26	+ 2.71	1.03	24	25	53.0	1, 13	32.0	8, 17	2	...		
XXVII.	Hawick (Silverbut Hall)....	3.32	...	.73	24	22	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House)....	2.38	— .98	.49	5	20	53.0	29	27.0	27	5	15		
XXIX.	Castle Toward	5.37	+ 1.63	.82	25	20	51.0	7	29.0	...	...	...
XXX.	Leven (Nookton)	4.06	+ 2.36	1.20	24	18	50.0	1, 23	26.0	8	8	18		
XXXI.	Stirling (Deanston)	4.12	+ 1.12	.82	24	22	52.1	1	24.5	27	8	13		
XXXII.	Logierait	6.08	...	1.27	26	18	...	...	...	...	...	...
XXXIII.	Ballater	8.74	...	2.80	25	13	53.0	29	24.5	8	14	...		
XXXIV.	Aberdeen	5.08	...	.96	25	24	53.6	29	31.1	8	2	13	
XXXV.	Inverness (Culloden) .....	.52	...	.12	1	10	51.4	1	31.9	8	1	19	
XXXVI.	Portree	5.57	— 4.66	.93	19	22	...	...	...	...	...	...
XXXVII.	Loch Broom	2.12	...	.36	26	13	...	...	...	...	...	...
XXXVIII.	Helmsdale	1.76	...	.33	25	15	...	...	...	...	...	...
XXXIX.	Sandwick	2.16	— .32	.47	17	23	49.6	1	32.1	21	0	11		
XL.	Cork	5.32	...	.81	23	20	...	...	...	...	...	...
XLI.	Waterford	5.52	+ 3.49	.77	8	21	52.0	25‡	32.0	19	1	...		
XLII.	Killaloe	4.60	+ 1.69	.60	28	23	58.0	13	30.0	19	7	15		
XLIII.	Portarlinton	3.12	+ 1.09	.56	1	28	54.0	24	32.5	18	...	...
XLIV.	Monkstown	3.49	+ 1.85	.58	4	18	61.5	24	29.5	7	1	1		
XLV.	Galway	3.93	...	.48	15	21	53.0	10§	32.0	19	0	...	
XLVI.	Bunninadden (Doo Castle) ..	3.60	...	.60	23	18	50.0	9	29.0	8	2	...	
XLVII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	3.07	...	.46	12	20	54.0	9, 25	28.0	26	3	15	
XLIX.	Strabane (Leckpatrick)	3.79	...	.40	24	25	...	...	...	...	...	...

* And 18. † And 29. ‡ And 26. § And 13, 24, 28. || And 27. ¶ And 18.

+ 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. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LINTON PARK.—A mild and dirty, but not wet month. Aurora on the evening of the 4th; fogs on 2nd, 9th, 16th, and 22nd; slight frosts on five mornings only; bar. generally steady until the last week; wind S., S.W., and S.E. on 25 days; vegetation advancing, but not so forward as might be expected from the long period of mild weather we have had, which contrasts strongly with February of 1855, when we had 26 frosty days, and the average temp. of the whole month was only $28^{\circ}\cdot66$ against $43^{\circ}\cdot96$ of the past month, a difference of 15° ; max. bar. $29\cdot81$ on 27th; min. $29^{\circ}\cdot23$ on 24th.

SELBORNE.—An unprecedentedly mild and damp February; catarrh almost universal; prevailing winds S.W., with scarcely an exception, till the 26th; birds pairing, and progress of vegetation unusually early. In the last fortnight of December, and the months of January and February (73 days), there were only 19 days without measured R; fogs on eight days; violent wind, S.W. on 4th; fine aurora on 4th and 6th; T with much L on evening of 14th, at 9 p.m.

CULFORD.—Magnificent aurora on the evening of the 4th; easterly winds during 15 days, and westerly during 14 days, altogether a month of exceedingly mild weather for February, the mean temp. being $43^{\circ}\cdot5$, and as a consequent result, vegetation is generally in an unusually forward condition, and very severe weather occurring now, would doubtless prove seriously injurious to many things.

BRIDPORT.—Aurora on 4th; large lunar halo on 21st; solar halo at 4:30 p.m. on 23rd; peaches and apricots in blossom at the end of the month.

BODMIN.—A magnificent display of aurora between 6 and 8 p.m. (on the 4th), when cloud came on; nothing equal to this marvellous sight has ever been witnessed here; at 7.15 p.m., the most brilliant streamers of deep rose colour and bright white light radiated from a point close to the Pleiades, and extended to an immense distance; at 7.30, streamers of the same colours formed just below Capella; a beautiful Maltese cross, and so bright at times was the light that every slate on the roof could be counted; the S.E. wind blew with a force of 8, and brought dense clouds, which obscured all the sky at 8 p.m. The rainfall of this month $9\cdot59$ in., and of January $10\cdot18$ (together $19\cdot77$ in.), is far greater than any recorded during the past 23 years; mean temp. of month $46^{\circ}\cdot1$, being no less than $3^{\circ}\cdot2$ above the average.

HAUGHTON HALL.—Another rainy month, the wettest February for 38 (or more years), as was January, thus exceeding the average of seven years by $1\cdot12$, as January did by $2\cdot30$; the winds, with three exceptions, never left the S. quarter, in which they had continued throughout the previous month; only six frosty nights; the max. temp. low, but equable, the bar. remarkably so; a sudden rise on 27th from $29^{\circ}\cdot24$ to $29^{\circ}\cdot80$, with change of wind from the S.W. to N.; brilliant aurora on the 4th, at 6.30 p.m., commencing in S.W., and veering round to N. and N.E.; snowdrops open on the 1st; primroses on the 6th; crocuses on 15th; black-bird first heard on the 24th.

ORLETON.—A very rainy, gloomy month, with frequent fogs, but no T or L; the rainfall in February during 41 years, has only once reached $4\cdot00$ in., and that was in 1833, when it amounted to $5\cdot725$ in. after a very dry January, and was followed by a dry March; bar. steady, but much below the average; the land saturated with wet all the month; temp. nearly 3° above the average, and tolerably steady, with a few frosty mornings; rough winds on 10th and 29th; aurora in S.W. at sunset on the 4th.

WIGSTON GRANGE, LEICESTER.—Remarkable humidity throughout the month, the ground too wet to flow or spread manure; both rainfall and temp. above the average for February; vegetation very forward.

BOSTON.—Very wet all the month. River Wotham in flood. Fen-lands much under water, and ground so wet that spring corn could not be sown; very mild in temperature; snowdrops and hepatica in flower on the 2nd. Vegetation too much vanced at the end of the month.

GRIMSBY, KILLINGHOLME.—February has well maintained its character of "Fill Dyke;" the ground is so wet that gardening is at a stand still; we have had no frost beyond rime on the grass; crocus began to flower on 1st; snowdrops in flower on 7th; hepatica on 12th; yews shedding pollen on 21st; skylark singing on the 2nd; frogs spawning on 23rd; distant T in S.W. and S. in the evening of the 23rd.

DERBY.—This month is remarkable for its high temperature, the ther. (5 feet above ground), never once reaching freezing point; the mean temp. for the month is 4° above the average, and the rainfall double the mean of 21 years.

MANCHESTER.—A fall of more than 1·00 on 29th, and flood of the Irwell.

YORK.—Constantly damp, though no heavy falls of R; aurora on 4th and 9th; solar halo on 23rd; lunar halos on 16th and 23rd.

NORTH SHIELDS.—Rose-coloured aurora on 4th.

W A L E S.

HAVERFORDWEST.—The wettest February in my 23 years' record, and characterized also by exceeding mildness; spring flowers in blossom; peach bloom almost fully out; bar. low all the month, an almost entire absence of frost, and no heavy storms of wind; some of the fine days interspersed towards the end of the month between the wet ones, were very lovely; prevailing winds S. and W.

CEFNFAES.—The month damp and wet; temp. mild; wind N.W. and S.E.; ten days without rain.

LLANDUDNO.—Splendid aurora on evening of 4th.

S C O T L A N D.

DUMFRIES.—There have been only four days during the month on which no rain has been recorded; on 16th and 17th some snow fell; several strong gales during the month; rainfall nearly double the average; mean temp. of the month 42°·9, or 1°·61 above the corresponding month last year; vegetation in an unusually forward state; fields verdant, and fruit trees bursting into bloom; on the night of the 4th a most magnificent aurora.

SILVERBUTT HALL, HAWICK.—The mildest and wettest February ever remembered here; on the 2nd a sparrow's nest was discovered in the ivy on a house in Slitrig Crescent, containing four eggs; the pastures are much greener now than they were in the middle of April last year; most splendid aurora on the night of the 4th; on 15th quite springlike for warmth, but no sunshine; on the following day cold easterly wind and S showers; rivers flooded on 24th and 25th.

AUCHENDRANE.—This February has been a month of low bar., with small range, and although the mean temp. exactly accords with our February mean, the humidity is greater, but the rainfall less, and extending almost as a drizzle over 20 days, the vapour-forming action has been stronger than the vapour-condensing power, which may, perhaps, be owing to the presence of only five days of Polar winds, four of calm, and 20 of equinoctials; the storms of the 24th, 25th, and 26th seem to have been accompanied by a bar. depression in the W.; the wind here on the 24th was E., which veered to S. on 25th, and backed again to E. on 26th, and ended in a calm on the 27th; the soil has not recovered from its January soaking, and the rivers are yet large. Beautiful aurora on the 4th; severe TS on 6th.

NOOKTON.—On 4th fine coloured aurora, reaching to the zenith.

DEANSTON.—Gale of wind and R on 1st from S.W., but the wind shifted about midday to E.S.E., and it cleared; aurora on 4th; gale on 12th, E.N.E., and very cold, rainy, stormy, and some sleet; 18th blasts; some L and distant T, and till the end of the month alternate days of rain, some frost and bright sunshine; very changeable; during the whole month no S except on the mountains; on 25th heavy R and floods in the rivers; smart frost on the night of 26th and morning of 27th; since then fresh and mild; very showery.

LOGIERAIT.—The aurora very visible on the 4th, converging from all points to the zenith continual, ever changing its pencillings from 5.30 to 10 p.m.; a month of remarkably heavy rainfall, and what is almost without parallel, the month of February without S, and almost without frost.

BALLATER.—A wet month altogether; the total rainfall much above the average; vegetation unusually advanced for the season.

ABERDEEN.—A mild, but wet, stormy month, indeed the wettest February on record ; several heavy storms, especially from S.E. ; no S, a little sleet and H ; hoar frost on eight days ; mean temp. $40^{\circ} \cdot 9$, or $3^{\circ} \cdot 3$ above the mean of 15 years ; S.E., S., and S.W. winds in excess of average ; estimated pressure rather below it ; red aurora on 4th ; L on evening of 15th.

PORTREE.—On the whole, this has been a mild, open month ; a very strong gale from the S. on the 4th, which continued all day ; S showers on 16th, 17th, 18th, 19th, 20th, and 21st ; frost on 24th and 27th ; fruit trees and bushes I fear are too far advanced in the bud so early in the season ; I strongly suspect they will get a check before March is out.

LOCHBROOM.—This has been the most remarkable February for warmth and mildness in the memory of anyone here, and the aurora, or rather red sky seen on the night of the 4th was the grandest ever seen here ; beautiful weather, more like summer.

I R E L A N D.

WATERFORD.—On the 4th there was a fine display of aurora, becoming visible soon after dark, and lasting several hours.

MONKSTOWN.—Dark crimson aurora on 4th ; the wettest February for eight years ; very little frost ; vegetation progressing rapidly.

DOO CASTLE.—Wet and cold month ; no farming operations carried on ; land completely saturated.

WARINGSTOWN.—Fine aurora from dusk till late at night on 4th ; month wet and warm ; occasional fine days ; land saturated, and labour greatly delayed.

PLACING RADIATION MINIMUM THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—It being admitted that uniformity of procedure in the method of carrying on meteorological observations is the one great desideratum for obtaining accurate data from a comparison of different records, the question, "How should self-registering minimum thermometers be exposed on grass?" suggests itself as one the discussion of which would be both interesting and advantageous to a great many of your readers, and especially to those among them who, like myself, are but simple amateurs.

I have been urged to propound this query from finding a diversity of practice to exist on the part of various observers, together with the want of any definite instructions generally accessible.

My custom has hitherto been to suspend the instrument—with its lower edge resting on the ground—under a species of small penthouse, so as to shelter it from the rain and the sun. But I find this a usage far from universally conformed to, whence I conclude I may be in error in the adoption of it ; and have, therefore, been led to believe that the ventilation of the subject by you might possibly set right, and oblige many besides your humble servant.—I am, Sir, yours truly,
F. BONNYCASTLE GRITTON.

West Tytherton, Chippenham, Wilts, Jan. 23rd, 1872.

[We should be glad to hear (not necessarily for publication) who are the other observers who have adopted this penthouse plan. Some persons do put their grass min. into a box during the day, for fear it should get too hot and burst, or evaporate its spirit to the top of the tube. Properly made thermometers will commit neither of these offences, and we leave ours resting on grass, night and day, winter and

summer, all the year round, and never have had anything go wrong, except when a pet quadruped put her foot just in the middle of the middle of the tube (we use *no* shield), with a result fatal to that thermometer. Letters, such as the above, strongly illustrate the necessity for a complete set of "Rules for Observers" for *all* subjects, similar to those adopted for rainfall.]—Ed.

DECREASE OF RAINFALL WITH ELEVATION.

To the Editor of the Meteorological Magazine.

SIR,—Let me explain to Mr. Malet that it was only as to particular mechanical forces that I supposed the atmosphere to be a regulator of rainfall. Does Mr. Du Port allow for the gain which, as rain-drops increase in size, accrues to the (constant) gravitation force, as against the retarding force of the air, and the (variable) deflecting force of the wind; and for the tendency of the last by its vertical and horizontal undulations to distribute the fall (even of continuous rain) in successive volumes of intermittent density? From the complex action of these forces, the different sized drops fall at different velocities along intersecting paths, coalescing more and more so as to give a maximum density at the lowest horizontal section of each centre of the fall; *i.e.*, the gain or loss, by unequal distribution in the vertical and horizontal, longitudinal and lateral, sections of the fall, is unequally compensated by the cumulative process of coalescence, so as to affect elevation-differences.

Nor should it be forgotten that, owing to the relative density of water and air, a column of rainfall brings down with it a current of cold air by which additional moisture is condensed. (I offer this in reply to Mr. Stow's objection, Vol. VI., p. 70, lines 8—15.) But on this intricate question I will only touch so far as to ask whether, taking the under surface of the clouds as the boundary line where visible condensation of aqueous vapour in colder air begins, we may not, as a rule, reckon the visible cloud above as a proportional measure of the invisible moisture below that line, and so infer that rainfall generated above will probably gather volume in its descent? In fact, is not each separate cloud the upper segment only of a volume of moist air?

Yours faithfully,

HUGH INGRAM.

Steyning, 7th March, 1872.

To the Editor of the Meteorological Magazine.

SIR,—The important qualification in the matter of atmospheric humidity contained in Mr. Stow's last letter, enables me to agree with him on that point. With regard to "Decrease of Rainfall with Elevation," I fear that the terms I used to place the pole and hill in strong contrast have impressed him with an idea of my views which is a little overstrained. If Mr. Stow means by a hill something shaped like a church tower, or sugar loaf, it is obvious that in proportion as it approaches such a form it will behave like towers and poles in catching rain; but that was not my meaning. The point I wished to enforce was

that elevated grounds catch much more rain than poles of the same height on plains, although equally exposed to the force of the wind. I will mention practical illustrations from this neighbourhood. The quality of the air brought up by the rain-bearing winds in Glamorganshire is very uniform, but the local distribution of the moisture varies considerably. The rainfall last year, at Cardiff and the surrounding lowlands, was from 37 to 41 inches, and about 18 miles to the S.W., close to the Bristol Channel, it was only 33·55 inches at 40 or 50 feet above half-tide level. In the hill country beyond, at elevations ranging from 350 to above 1000 feet, it varied from 47 to 76 inches. At some of these stations the gauges are freely exposed to the wind, so the angle at which the rain falls cannot differ much from that of one on a pole of the same height. Now if the hills were levelled, and the gauges left suspended on poles in the same localities and under precisely the same general atmospheric conditions they would receive next to nothing, instead of 50 or 70 inches. I regard this hill country as a mountain mass, although it is furrowed with valleys, and has summits and ranges of different altitudes. Comparison of the returns shows variation from height, and the many other circumstances that modify rainfall; but taking the hill gauges individually, and the average of them collectively, they *all* show a large excess over those of the lowlands, and still more so above one on a pole even one-tenth of the height on the plains to the S. or S.W. We constantly see rain falling heavily on these hills and valleys, and I remember a serious flood that much damaged a railway resulting from the bursting of a storm cloud on the highest hill in the county. In my previous letters I have not compared the rainfall of the hills with that of the valleys, but I feel sure that the influence of the former increases the rainfall of the latter in a very high degree. I believe that in some instances the rainfall of the vales exceeds that of the summits. The broad principle I advocate is that elevated regions of hills and valleys fully open to the wet winds receive more than their share of rain, and that gauges placed on poles in the plain catch less although the angle of fall cannot be very different. These facts prove that the angle cannot cause a loss of more than a small discount from the total, and that the pluvial process is cumulative, as I tried to show in my first letter. This latter point is confirmed by the softness and gentleness with which rain usually falls, and which could not be the case if the drops were all fully formed at a great elevation. Apologising for again troubling you, and promising not to trespass further upon your space in this controversy.

I am, &c., yours faithfully,

FRANKLEN G. EVANS, M.R.C.S., F.M.S., &c.

Tynant Radyr, near Cardiff, Feb. 17, 1872.

P.S.—A gauge on a pole 100 feet high at Cardiff would not catch 20 inches, although others 600 feet higher on the hills catch 60 or 70 inches, and yet the rain must pass over the lowlands before it can reach the mountains. The rainfall in the elevated valleys is great, because they get the advantage of the attraction of the mountain mass plus the cumulative effect of the moisture of the valley.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

LXXV.]

APRIL, 1872.

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ANOTHER METEOROLOGICAL CONGRESS.

(Continued from page 24.)

Number and Disposition of Observatories.—Dr. Ballot commences by pointing out that however pleasant it may be to the patriotic sentiments of the inhabitants of each country to expend all the money each can devote to Meteorology in their own territories, such a proceeding is not necessarily nor generally wise, as viewed from a scientific point of view.

There should, he thinks, be in each country three classes of Meteorological Observatories,—(1) central ones, with self-recording instruments of the best class; (2) subsidiary ones, taking frequent eye observations; (3) others devoted mainly to rainfall and extraordinary phenomena. He thinks that the first-class stations need not be closer than fifty leagues one from another, but that possibly the Congress might settle a limit of forty instead of fifty; the precise distance being of course controlled in each case by suitability of position and other circumstances known only to the meteorological director in each country. Making allowance for additional stations on some of the more remarkable mountain tops, Dr. Ballot is of opinion that if re-arranged, the total number of European stations might be considerably reduced; and he then proceeds to point out the lack of observations from Africa, Asia, and Australia, but seems to us scarcely to recognise all that has been done in those countries, *e.g.*,

“Africa is uninhabited for the greater part; France could give us the North coast, England has done much on the South point, and along the Suez canal some stations have arisen.”

We admit that African meteorology is not yet very voluminous, but our readers will recollect the monograph of Prof. Raulin on Algerian rainfall, the splendid sets of observations from Oran, Constantine, and other stations, not merely on the coast, but penetrating hundreds of miles inland, to the verge of the Great Sahara; then going to the west coast, we have on our own shelves, several sets of observations from Gambia, Gold Coast, and Sierra Leone; while on the east we have D'Abbadie's Memoir on Thunderstorms in Ethiopia, fragmentary but instructive observations from Abyssinia, and though last not least, Dr. Mann's systematic records from Natal. We have not included

Cairo, Alexandria, or Aden, because though we believe that observations are made at all three, we are not certain that such is the case. We admit that these are not first-class stations, but think that they were entitled to a passing notice; so also was the great work effected under the direction of General Sabine in conjunction with the establishment of the British Colonial Magnetic Observations.

But, although claiming that these various efforts should not have been altogether ignored, we admit the broad general fact which Dr. Ballot puts before us, viz., the desirability of a more equal geographical distribution of observing strength.

On this point we have only to remark that although perhaps a Government might hesitate about the cost of establishing numerous first-class stations,—and even meteorologists might find it hard to prove the necessity for such an expenditure—we are certain that it only requires co-operation among meteorologists and personal energy among those who might be appointed directors, to ensure, within three years of the present time, the inauguration of a network of stations which should “gird the earth” in something more than a flower of speech. Take England, for instance; look down the list of her consular agents, her military and naval stations, and those of the missionaries attached to her various religious societies. Can any one say why these should not be utilized? English clergy take their daily observations before and after service, and we believe that many a missionary in Zululand, or the Arctic circle, would rejoice in another tie to bind him to civilization and the land of his birth. Before any such proposal is brought forward two things in particular *must* be done,—(1) absolute and definite decision as to instruments, position, time of reading, mode of reduction, and publication, must be adopted. This is the main object proposed for the congress, and none more important could be laid before it. (2) Meteorologists must agree together, and unitedly bring the subject before Government; they have ample power to claim attention to their requests, if only they will combine to exert it.

With one caution we leave this subject. It is no use supplying instruments and printing forms if the observers neglect their work; it is, therefore, indispensable that every precaution be taken in the selection of observers. It is our belief that out of any five good meteorological instruments made, not more than two or three, at the utmost, ever furnishes observations of the slightest use. We have in our memory the flourish with which it was announced that instruments costing several hundred pounds were on their way to a certain island; we heard of their arrival, but, alas, we have never seen a single reading from any one of those hundred instruments. Let this be a warning to us all.

Number of Observations to be published.—We think this the weakest section of Dr. Ballot's pamphlet. As far as it goes we agree with it, but it does not go sufficiently into detail. Essentially it amounts to this:—that it is more to the interest of Meteorology to expend money in securing proper geographical representation (by establishing stations

in districts hitherto unprovided) than in the publication *in extenso* of the results obtained at existing observatories. That, as a rule, only a very small portion of the observations at any station are required for discussion by others than the director of that observatory, and, therefore, that the requirements of science are most cheaply and yet perfectly met by manuscript extracts, and of course (though Dr. Ballot does not say so) by annual abstracts. With reference to the second-class stations, Dr. Ballot writes :—

“When we look at the observatories of the second order, it is quite sufficient if they give a record of their observations, which may be very explicitly printed on one sheet of paper, for a whole year ; perhaps the observer can persuade the editor of the local newspapers to give a separate copy of those daily communications, and to collect them every month, as we have often proposed, and to have some copies sent to the observer, that he may disperse them. In this case the charge will not be heavy, which is a desideratum ; but, on the whole, we must be very economical in printing, because there is so very much that must be communicated.”

Considering the large experience of Dr. Ballot, we think it is to be regretted that he did not give specimens of the forms which seem to him most suitable. One of the greatest drawbacks to Meteorology is discordant publication, and this is essentially a point for a congress to settle. Take our own country as an illustration ; there are the following establishments and systems supported by the National Exchequer—

Meteorological Office,
Royal Observatory, Greenwich,
Army Medical Department,
Registrar-General, England,*
„ „ Scotland.*

It is hardly to be credited, and yet we believe it is a fact, that of these five departments no two agree in their mode of treating or publishing observations ! Surely, if no other country requires a congress, we need one for ourselves, or a thorough reform which shall sweep away individual crotchets, and utilize the observing strength and pecuniary resources of British Meteorology.

Invariability of chosen hours and instruments.—This section contains two points with both of which we agree, but we think it should have contained a third. The first is, that as every instrument is liable to go wrong, or to be broken, duplicates should always be in store, and compared monthly with those in use. As to the wisdom of this rule, especially at remote stations, there can be no question. The second point is equally important, viz., that hours of observation once selected should not be altered except with great consideration and the sanction of the supreme authority to whom the results are communicated. To these points we should have added a third, viz., that all observers acting together, observe at the same hours.

Astronomical or local time. *What hours ?* This section states the arguments *pro.* and *con.* very impartially and clearly, but does not

* Observations made by private gentlemen, cost of reduction of observations alone charged.

leave on our mind any distinct impression but one, viz., that Dutchmen are early risers. Dr. Ballot says that if three daily observations be decided upon, they ought to be at 6 a.m., 2 p.m., and 10 p.m. We sincerely hope that the congress will not assent to this proposal, for in this country we believe three-fourths of the observers would decline to adopt it. And this early rising runs through all his proposals, for he suggests that if only one observation is made, it should be at 7 a.m., and if two hours, then homonymous hours, either 6 and 6, 7 and 7, 8 and 8, or 9 and 9. Speaking both for English and Scotch, we clutch at the mention of 9 a.m. and 9 p.m.—hours already adopted by the larger part of the observers in England, and by nearly every one in Scotland. Evidently there will be considerable difficulty in securing uniformity of practice, in consequence of the change of habit and (almost) of mode of life which it will compel. Perhaps as every station will have self-registering thermometers, and observations at the same hour of local time will not be synchronous over large tracts, national habits may be allowed some weight, and absolute uniformity not be considered indispensable.

REVIEWS.

Devonshire Hospital and Buxton Bath Charity. Annual Report for 1871. Buxton: J. C. Bates. 8vo., 53 pp.

ALTHOUGH this is merely the report of a charitable institution, the fact that it is the medium (and the only one) of obtaining full information as to the climate of one of the most bracing of our English health resorts, has induced us annually to bring it before the notice of our readers. Last year we pleaded for the insertion of a few tabular values; this year we are glad to find that the hospital authorities have inserted two pages of tabular matter, very well arranged by their observer, Mr. E. J. Sykes, F.M.S.

From these tables we have extracted certain salient data, and placed them in juxta-position with similar values from Braemar, Buxton's more northern representative, and Worthing, a type of the warmer climates of our south coast. We may just mention, for the convenience of those unacquainted with these three localities, that Braemar is near the source of the Dee, in Aberdeenshire, about forty-six miles from the sea, and 1,100 feet above it, with lofty mountains in its vicinity, especially on its western side; Buxton is at almost exactly the same altitude, but centrally situated in the hilly part of Derbyshire, and like Braemar, more or less surrounded by ground of greater altitude than that on which the town is built. Worthing differs from these two localities in every respect; it is on the coast (in Sussex), only a few feet above the level of the sea, and with no high land in its vicinity. In one respect the materials for comparison are unsatisfactory; the thermometers at Braemar and Worthing are placed in Stevenson's stands, those at Buxton on one of Glaisher's pattern; the result of this is that the range of temperature both daily, monthly, and annual, at

Buxton appears larger by several degrees than it would have done if all three stations had been similarly equipped. With these prefatory remarks we now give the comparative table.

MONTHLY TEMPERATURE IN SHADE.										RAINFALL.	
		Mean.	Max.	Min.	Range.	Mean daily Range.		Amount.	Days.		
Jan. ...	{ Braemar ...	28·7	45·8	9·3	36·5	12·3	...	0·61	...	7	
	{ Buxton	29·6	44·0	—2·5	41·5	12·9	...	2·05	...	19	
	{ Worthing ...	34·9	45·1	20·9	24·2	8·4	...	3·36	...	18	
Feb. ...	{ Braemar ...	38·2	48·7	27·0	21·7	8·5	...	3·62	...	11	
	{ Buxton	41·3	52·5	20·5	32·0	13·5	...	4·91	...	22	
	{ Worthing ...	41·7	53·4	26·2	27·2	8·0	...	1·58	...	16	
March	{ Braemar ...	40·7	61·1	22·0	39·1	15·2	...	2·73	...	15	
	{ Buxton	41·9	68·0	18·0	50·0	17·7	...	1·87	...	14	
	{ Worthing ...	44·6	62·7	30·4	32·3	10·9	...	·84	...	11	
April..	{ Braemar ...	38·7	56·8	22·3	34·5	14·8	...	2·65	...	20	
	{ Buxton	42·8	60·0	18·0	42·0	15·4	...	4·31	...	23	
	{ Worthing ...	47·8	60·6	34·4	26·2	10·6	...	3·96	...	17	
May ...	{ Braemar ...	47·5	72·6	26·4	46·2	20·8	...	1·06	...	10	
	{ Buxton	46·5	76·0	25·0	51·0	21·8	...	3·54	...	24	
	{ Worthing ...	51·0	70·8	35·8	35·0	15·9	...	0·46	...	4	
June ..	{ Braemar ...	50·5	69·8	32·2	37·6	15·6	...	1·90	...	17	
	{ Buxton	50·0	71·5	33·5	38·0	17·7	...	3·82	...	20	
	{ Worthing ...	53·6	68·7	37·2	31·5	14·4	...	2·62	...	16	
July ...	{ Braemar ...	54·0	67·3	34·7	32·6	15·1	...	3·74	...	23	
	{ Buxton	54·9	78·0	38·0	40·0	16·4	...	5·09	...	28	
	{ Worthing ...	59·8	75·2	48·2	27·0	10·1	...	2·89	...	12	
Aug. ...	{ Braemar ...	56·7	74·0	36·3	37·7	17·1	...	2·49	...	12	
	{ Buxton	58·2	84·0	35·0	49·0	22·4	...	3·24	...	12	
	{ Worthing ...	63·1	85·1	48·2	36·9	15·8	...	1·54	...	6	
Sept. ...	{ Braemar ...	49·4	69·2	25·3	43·9	14·6	...	3·74	...	15	
	{ Buxton	50·7	72·0	29·5	42·5	16·2	...	5·77	...	16	
	{ Worthing ...	58·3	77·8	40·2	37·6	13·1	...	3·07	...	10	
Oct. ...	{ Braemar ...	43·8	58·0	23·3	34·7	12·9	...	4·51	...	21	
	{ Buxton	46·3	63·0	24·0	39·0	14·7	...	5·99	...	21	
	{ Worthing ...	52·4	64·5	38·4	26·1	12·1	...	1·36	...	14	
Nov ...	{ Braemar ...	36·0	57·2	20·8	36·4	10·9	...	1·70	...	10	
	{ Buxton	35·7	49·0	15·0	34·0	12·4	...	3·08	...	17	
	{ Worthing ...	40·2	54·3	26·4	27·9	10·3	...	0·62	...	7	
Dec. ...	{ Braemar ...	35·4	56·4	13·3	43·1	12·5	...	1·61	...	14	
	{ Buxton	36·7	49·0	5·5	43·5	9·9	...	3·45	...	24	
	{ Worthing ...	39·4	50·2	22·3	27·9	9·4	...	1·38	...	12	
Year ..	{ Braemar ...	43·3	74·0	9·3	64·7	14·2	...	30·36	...	175	
	{ Buxton	44·6	84·0	—2·5	86·5	15·9	...	47·12	...	240	
	{ Worthing ...	48·9	85·1	20·9	64·2	11·6	...	23·68	...	143	

The disturbing effect of different classes of thermometer-stands affects mean temperature very slightly, and hence the first column of the table is probably the most trustworthy. It shows that Braemar is colder than Buxton by an almost constant quantity of 1°, also that Worthing is warmer than Buxton by about 4°, and (which seems to us rather singular) that this difference is also nearly constant. We

should have expected to find the influence of the sea decreasing the difference in the summer and increasing it in winter, but the contrary seems to be the case, the average excess of the Worthing temperature in November, December, January, and February, was $3^{\circ}2$, and in May, June, July, August, it was $4^{\circ}5$. It may be that other years will alter this, but the differences run so evenly that we doubt it. We do not understand the relative warmth of Buxton and Braemar in winter which this seems to involve, and shall gladly see light thrown upon the question.

The second column is largely affected by the form of stands, but some information is to be obtained from it, *e.g.*, that though cooled by the sea breezes (and we know that many inland stations were far above 85°), Worthing was more than 10° hotter than Braemar. Buxton appears to hold an intermediate place (allowing 4° as the excess due to a Glaisher's stand in the position of that at Buxton). We should have thought it would have more closely approached its northern companion, but, probably, the exposed southern slope on which the hospital stands renders it warmer than many parts of Buxton. But we think that it is undeniable that, making all allowances for stands and position, the air on sunny days is hotter at Buxton than at Braemar, although we know no town south of the Tweed which can compare with it as a cool summer retreat, and only three villages, Prince Town, Dartmoor, Devon (altitude 1,400 feet), Allenheads, Northumberland (1,360 feet), and Shap, Westmoreland (about 900 feet).

The nights at Buxton are bitterly cold, at least that is our personal experience at various seasons of the year, and it is fully borne out by the table, even raising the readings 4° for the influence of the stand. We do not attempt to explain the *reason*, but the fact is evident that the minima recorded at Buxton are not only some 8° lower than at Worthing, but in the winter considerably colder than at Braemar. This is another enigma.

Next we come to yearly range of temperature, which is nearly identical at Braemar and Worthing, and very much greater at Buxton.

The daily range is (allowing for the stands) nearly identical at Braemar and Buxton, and 3° less at Worthing.

In rainfall there is a wide but easily understood difference between the stations; Braemar, for its altitude, has a remarkably small rainfall, caused by the fact that the clouds have been previously drained of their moisture by the higher lands of Argyleshire. Buxton has a large fall because it is to the N.E. of the high land of Axe Edge, which is almost the first land of any considerable altitude which meets the clouds after passing the ridges of the mid-Wales mountains. Worthing has a small rainfall because there are no elevations to cause precipitation.

One word in conclusion. Meteorologists are indebted for details of one of the most important climates in England, to a charity which requires additional funds, and copies of the Report, including the Meteorological Table, can be had from Mr. Taylor, the Secretary, for three penny stamps. We recommend our readers to send for the Report, and then to act as they see fit.

Quarterly Weather Report of the Meteorological Office. Part III.
July to September, 1870. Quarto. 17 pp., 18 plates. Stanford.

We hope that we are mistaken in an impression that this useful publication is getting further in arrear. It is, as we have said, only an impression, but whether it be correct or not, it is difficult to see why this quarterly publication should be considerably more than a year behind date, and as to that fact there is no shadow of doubt.

There are, in the letter-press, no special features calling for remark, except that in lieu of the small and effective woodcuts illustrative of baric areas, somewhat similar ones are given by the side of the plates of curves. We cannot say that we consider the alteration an improvement, but it is not very material, and will be still less so in future, when the daily maps will go far to supersede their necessity except for afternoon and night charts.

It may be in the recollection of some of our readers that an unusually heavy thunderstorm, with water-spouts and tremendously heavy rain, broke over the hills south-west of Todmorden, between two and three p.m., on July 9th, 1870. It was quite a local storm, and was about fifteen miles distant from Stonyhurst, where not a drop of rain fell, but the Stonyhurst curves give distinct indications of its occurrence. Owing to the contracted scale now adopted, it is impossible to read off precisely the amount of disturbance, but it seems to have been about 0.05 in. of the barometer, and a fall of about 4° or 5° in the temperature, the former a few minutes before three p.m., and the latter just at the hour. Simultaneously, or nearly so, the wind suddenly backed from S.W. to N.E., returning to S.W. in about a quarter of an hour.

HEAVY FALL OF SNOW.

To the Editor of the Meteorological Magazine.

SIR,—One of the most sudden and violent snowstorms I have ever witnessed occurred here this morning.

At 10.45 a.m. the atmosphere became as dark as midnight, and the wind, which had previously been light from S.E., fell calm; at 10.50 snow began to fall very heavily, and a strong N.N.W. breeze sprang up; the storm continued till about 1.30 p.m., when the snow was over 6 in. deep; the amount in the gauge when melted was .44 in. At 9 a.m. the sky was perfectly clear, with a hoar frost, the min. temp. having been 23°.—Yours truly,

THOS. PAULIN.

Winchmore Hill, 21st March, 1871.

To the Editor of the Meteorological Magazine.

SIR,—The extraordinary fall of snow during the last three days I believe to be quite unprecedented at this period of the year. I consider if it had remained it would have amounted to a depth of quite twenty inches! I have measured 1.46 in. of melted snow, but much of it did not enter the funnel of the rain gauge. Temperature has been very low.—Yours faithfully,

HENRY ST. JOHN JOYNER.

Northwick House, Harrow-sub-Colle, 23rd March, 1872.

NORWAY RAINFALL.

[As in former years, we are indebted to Mr. Cator for the following interesting particulars.—Ed.]

RAINFALL IN 1871 AT ÖJE, NEAR FLEKKEFJORD, NORWAY.

Rain Gauge.—Funnel, 12½ in. square; height of top above ground, 8 ft.; above sea level, 18 ft.

Month.	Total Depth.	Greatest Fall in 24 hours.		Days on which ·01 or more fell.	Days of Snow.
	Inches.	Depth.	Date.		
January	3·433	1·021	18	11	5
February	3·371	·497	24	18	10
March	1·840	·467	10	8	...
April	·508	·124	30	7	2
May	·343	·099	1	6	1
June	1·867	·570	1	12	...
July	4·235	·560	23	22	...
August	3·323	·889	19	10	...
September ...	1·558	1·268	5	7	...
October	2·895	1·031	7	11	...
November ...	4·488	1·303	13	13	3
December ...	6·802	1·959	20	18	3
Totals	34·663	...	...	143	24

The winter, 1870-71, extraordinarily cold, and unusually much snow. The weather only began to be warm on 20th May, and rain on 1st June.

On 9th March, thunder, hail, and rain; 15th March, hail and snow, and after a long continuance of N.E. wind, milder weather and cloudy sky; 18th March, extraordinarily bright aurora over the whole sky, with colors of the rainbow.

25th May, 77°; 26th May, 79°·3; 27th May, 88°·3 Fahr.

20th April, severe snow storm from N.E.; 24th June, 214 in. rain and hail fell in a few minutes; November and December, and up to 20th January, 1872, copious rainfall.

JENS BEER.

DECREASE OF RAIN WITH ELEVATION.

To the Editor of the Meteorological Magazine.

SIR,—I am surprised at two things; first, that Mr. Parnell's letter on "Altitude Difference of Rainfall" has passed unnoticed by any of your correspondents; second, that after its publication anybody should have had anything more to say. For my part I entirely withdraw, with shame and confusion of face, the letter I wrote on this subject, printed on page 134, of the last volume of the *Meteorological Magazine*.

I shall be still more surprised if any of your correspondents who understand Mr. Parnell's letter, and I confess it is not easy to understand, do not follow my example, wishing, as I do, that they had not written upon a matter they did not comprehend, if it were not that we dunces have stirred up somebody to give the matter under discussion a clear and philosophical demonstration.

It is perfectly marvellous that scientific men with brains, as many of your correspondents are, should have helped, like myself, to swell your last volume with such a mass of nonsense and irrelevant lucubrations as you have been good-natured enough to admit.

I confess I tremble at the thought of the scourging we are to receive in your anticipated editorial summing up.

I am, Sir, your obedient servant,

THOMAS E. CRALLAN.

Hayward's Heath, March 26th, 1872.

OBSERVATIONS AT PATRAS.

To the Editor of the Meteorological Magazine.

SIR,—I send you a second set of tables which give the result of my observations in Patras from June to December, 1871. The remarks that appeared in the July number of this magazine last year concerning the quality and positions of my instruments, and the nature of the neighbourhood, are still applicable. Neither mountains, nor sea, nor house have run away, nor have any of the instruments been broken. I have added, however, to my previous stock a second rain gauge, of 5 inches diameter, with graduated glass carefully prepared by myself, and tested by the measuring glass of the gauge already in use. This second gauge is kept on the wall of a terrace at the top of a house, about a quarter of a mile from the other. It is in quite a sufficiently open position, though 36 feet from the ground. This second gauge came into use on November 11, only a few days before the heaviest rains which I have ever yet seen. About these the table will speak for itself. The results of both gauges are given, that of the new one being placed on the right-hand side. The terrace gauge shows an excess of 4 per cent. over the other, which is slung in a court about 18 ft. from the ground, and very much overhung by the roof. Whenever the 5 inch gauge has registered a smaller fall than the old one, it has happened that the wind was blowing with some violence from the S.E. or S. Respecting the rainfall of the autumn and winter, I may observe that October and November this season have been altogether different from the October and November of my first autumn in the country. This will be clear by comparing the two sets of tables. I am told that though the rain has fallen at the usual times this year, it has come in much greater quantities than usual. The number of falls exceeding one inch in 24 hours has been very great. These falls come generally in very heavy showers, which continue from a quarter of an hour up to two and three hours. A steady, protracted rain we rarely have. The rainfall of Sept. 18-19, was the result of a very heavy thunder-shower between 6.30 and 8.30 a.m. on the morning of the 19th. The rains, however, both on December 9th and December 11th, were steady, protracted, and by no means heavy, accompanied by a light E. wind. Though the rains have been so heavy, there has been a remarkable absence of thunder and lightning.

In respect of temperature, my predictions in my last letter were fully justified. During the period from July 17 to August 5, the maxima ranged from 90° to 99°, and from July 18 to August 7 the minima ranged from 70° to 74°. On July 27, the hottest day of the

summer, another thermometer of mine, hung on an iron rail 2 feet clear of any wall, sheltered from the sun by a house, and from the wind by some trees on the opposite side of the road, and 13 feet from the ground, was seen at 105°. October was remarkable for its great range of temperature. The first eleven days shewed eighties and high seventies, nothing less than 77; while from the 15th onward it never reached 72. How much colder November and December, 1871, were than the corresponding months in 1870, will be seen by a reference to the tables.

The same remarks which I added to the table of clouds last summer are applicable to the one that I send now.

I enclose also a table of earthquakes. We had on the 21st of June a rather severe one, which set the chairs in rooms on the first floor of some houses rocking gently. I was indoors at the time, and saw a chair so shaking. For the next 5 months there was no shock distinctly perceptible to myself or any of my friends, an unusually long respite, for the which we have had to pay this January; December gave one, but of no great severity. January has given very many, one violent one, which brought down a great quantity of plaster from the cornices of the rooms, and caused great alarm. Part of a large convent in the interior of the Morea has been thrown down by one shock, and a huge rock on the road between Megara and Athens was brought down upon the road, destroying and blocking it up. The sensation is horrible; no motion of floors or walls is seen, except in very severe earthquakes, but a vibration passes through one's whole body, the floor or ground seems to be slipping from under one, while the straining of the timbers and walls of the house, and the rattling of doors and windows, are sounds not very pleasant to hear, when another instant may bring them all down together. A new comer is usually rather amused by the sensation, but after the first interest is passed, a feeling of horror rapidly comes instead, and the longer people stay in the country, the more they dread the earthquakes.

The worst earthquakes are felt round the shores of the Gulf of Corinth, particularly near Delphi; also in Zante, Cephallonia, and Leucadia, in each of which islands, within the memory of living men, towns have been more than half destroyed. Patras was destroyed 1,300 years ago, but it is supposed here that we are safe from any very great calamity.

After the experience of a year and a half, I can detect no connection whatever between the earthquakes and other meteorological conditions.

When I have been away from Patras for a time, I have been enabled to continue my observations by proxy, through the kindness of Mr. J. J. Tobler, a Swiss gentleman living here, whose careful assistance during my absence has prevented a good many gaps in the tables.

Yours very truly,

HERBERT A. BOYS.

Patras, Greece, January 31st, 1872.

Table of Temperature at Patras in 1871.

	June.		July.		Aug.		Sept.		Oct.		Nov.		Dec.	
	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day	Deg.	Day
Average max. temp.	83·0	...	90·7	..	89·8	...	82·3	...	73·1	...	65·2	...	54·7	..
Greatest max. temp.	92·0	26	99·0	27	96·0	13	88·0	11	85·0	$\frac{1}{8}$	73·0	$\frac{19}{11}$	68·0	5
Least max. temp.	77·0	15	83·0	$\frac{1}{16}$	80·0	31	77·0	19	64·0	27	58·0	$\frac{21}{2\frac{1}{2}6}$	44·0	27
No. of max. between 99 & 95	...		4		1		...		...		...		...
94,, 90	3		18		15		...		...		...		...
89,, 85	5		7		4		7		2		...		...
84,, 80	18		2		1		17		5		..		...
79,, 75	4		...		...		6		5		...		...
74,, 70	...		...		...		...		6		5		...	
69,, 65	...		...		...		...		12		14		3	
64,, 60	...		...		...		...		1		4		2	
59,, 55	...		...		...		..		...		7		10	
54,, 50	...		...		...		...		...		...		8	
49,, 45	...		...		...		...		...		...		7	
44,, 40	...		...		..		..		...		...		1	
Average min. temp.	63·4	...	69·5	...	68·7	...	64·1	...	57·3	...	51·4	...	41·7	...
Greatest min. temp.	67·0	$\frac{6}{22}$	74·0	$\frac{26}{289}$	72·0	$\frac{1}{28}$	70·0	$\frac{22}{28}$	70·5	2	59·0	10	56·0	1
Least min. temp.	58·0	2	64·0	1	59·0	31	58·0	15	47·5	23	45·5	$\frac{24}{28}$	31·0	19
No. of min. between 74 & 70	...		16		12		2		1		...		...
69,, 65	12		14		16		11		5		...		...
64,, 60	15		1		2		15		3		...		...
59,, 55	3		...		1		2		9		7		1	
54,, 50	...		...		...		...		12		13		2	
49,, 45	...		...		...		...		1		10		5	
44,, 40	...		...		...		...		...		...		11	
39,, 35	...		...		...		...		...		...		9	
34,, 33	..		...		...		...		...		...		2	
32,, 30	...		...		...		..		...		...		1	
29,, 25	...		...		...		...		...		...		...

Table of Earthquakes, 1371.

June.	July.	August.	Sept.	Oct.	Nov.	Dec.
18	2 .
21
22

The figures represent the days of the month on which the earthquakes took place, and the size of the dots indicates their severity.

Table of Clouds, 1871.

Scale.	June.	July.*	Aug.	Sept.	Oct.	Nov.	Dec.
10—8	1	...	...	...	2	7	9
7—3	16	7	9	12	22	21	20
2—1	12	10	13	11	7	2	1
0	1	4	1	7	...	...	1
...	2·9	1·8	2·3	2·0	4·3	5·5	5·8

* Omitting from July 22nd to August 8th, inclusive.

The cloudiness of each day is indicated by figures ranging from 0 up to 10.
0 representing perfect clearness.

1, 2 „ clouds hanging on mountains only.

3 up to 7 „ different degrees of cloudiness over Patras.

8 to 10 „ different densities of clouds when the sky is entirely covered all day.

The above table shows how many days of each sort there were in each month.

Table of Rainfall at Patras in 1871.

Second Gauge.

Date.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Nov.	Dec.
1...
2	·29	...		...
3...	·69	...		...
4...	·50	...		...
5...	·44		·45
6...	·84		·83
7...	·25		·19
8...	·17		·17
9	1·08		1·11
10...	·94	1·09	·35		·39
11...	·01	...	·02
12...	1·39	·13	...	·11	...
13...	1·36	·02	...	·03	...
14...	·41	...	...	...	·17	...	...	...	...
15...	·13	...	...	...	...
16...	·86	...	1·65	...	1·80
17...	·22	...	·23	...
18	2·00	..	·37	...	·39	...
19...	1·31	...	1·40	..
20...	·15	·81	...	·86	...
21...	·10	·64	·08	·70	·08
22...	·08	...	...	1·06	...	1·09	...
23...	·14	...	·14	...
24...	·85	·19	...	·20	...
25...	·59	·20	·11	·23	·09
26...	1·14	·12	1·12	·10
27...	·07	...	...	...	..	·88	·29	·83	·36
28 ..	·52	...	...	...	...	...	·24	...	·25
29...	·09	...	·03	...	·01	...	·01
30...	·01
31	·18	·32	·14	·34
Total..	1·00	...	·17	2·00	6·57	9·86	5·96	7·47	6·20

On November 11th, a second gauge was set up, and its results from that day to the end of the year are given at the end of the table.

MARCH, 1872.

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		In shade On grass.							
				Dpth.	Date.			Max.		Min.			
								Deg.	Date.	Deg.	Date.		
I.	Camden Town	inches 2.66	inches. + .58	in. .69	28	17	61.1	6	26.1	26	9	12	
II.	Maidstone (Linton Park)	1.93	— .56	.69	28	15	65.0	15	24.0	26	...	11	
III.	Selborne (The Wakes)	3.02	+ .42	1.17	28	15	56.2	16	23.6	26	10	13	
IV.	Hitchin	1.97	— .20	.58	22	14	59.0	30	25.0	20	12	...	
V.	Banbury	2.11	— .09	.59	27	15	60.0	6	25.5	26	11	...	
VI.	Bury St. Edmunds (Culford)	2.50	+ .30	.48	23	16	61.0	30	23.0	20	12	18	
VII.	Bridport	3.00	+ .13	.65	27*	19	59.0	16	22.0	26	9	...	
VIII.	Barnstaple .....	...	...	...	...	...	...	...	...	...	...	...
IX.	Bodmin	5.49	+ 1.74	1.19	27	23	58.0	16	30.0	24	5	11	
X.	Cirencester	2.54	— .06	.71	27*	14	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall)	2.04	+ .10	.50	17	15	58.0	30	24.0	26	11	...	
XII.	Tenbury (Orleton)	2.30	— .12	.56	27	18	60.0	30	23.2	26	10	13	
XIII.	Leicester (Wigston)	1.90	— .21	.37	28	15	62.0	30	23.0	25	9	...	
XIV.	Boston	2.36	+ .57	.57	21	17	60.0	30	28.0	26	6	14	
XV.	Grimsby (Killingholme)	2.27	..	.34	17	19	58.0	4†	27.5	26	6	...	
XVI.	Derby	1.84	— .40	.41	17	16	60.0	5	26.0	26	8	...	
XVII.	Manchester	2.78	+ .09	.78	17	19	64.0	30	27.0	26	8	11	
XVIII.	York	2.17	+ .18	.40	27	20	58.5	3	26.0	26	7	...	
XIX.	Skipton (Arncliffe)	6.39	+ 1.58	1.35	27	23	...	...	...	...	...	...
XX.	North Shields	3.45	+ 1.10	.40	20	19	55.6	16	25.0	26	9	10	
XXI.	Borrowdale (Seathwaite)	11.23	— 2.17	1.98	17	15	...	...	...	...	...	...
XXII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest	5.37	+ 1.92	1.44	27	17	59.5	30	26.0	25	9	10	
XXIV.	Rhayader (Cefnfaes)	3.51	— .33	1.00	27	12	59.0	...	23.0	...	6	...	
XXV.	Llandudno	2.19	— .07	.63	27	17	62.0	7	30.7	22	3	...	
XXVI.	Dumfries	3.06	+ .08	.43	1	19	56.0	29	24.5	26	7	...	
XXVII.	Hawick (Silverbut Hall)	2.56	...	.56	28	20	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House)	2.58	— 1.15	.66	11	14	61.0	6	21.0	26	8	11	
XXIX.	Castle Toward	4.35	— .24	1.60	12	14	57.0	8	23.0	6	...	...
XXX.	Leven (Nookton)	2.61	+ .54	.44	11	23	55.0	15‡	26.0	21	10	18	
XXXI.	Stirling (Deanston)	3.74	+ .21	1.15	11	20	60.5	3	21.5	26	11	12	
XXXII.	Logierait	1.82	...	.73	29	16	...	...	...	...	...	...
XXXIII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Aberdeen	2.28	...	.33	24	25	55.5	4	28.8	21	6	19
XXXV.	Inverness (Culloden) .....	.84	...	.29	22	17	56.6	4	29.5	21	3	18
XXXVI.	Portree	5.16	+ 3.88	1.65	11	21	...	...	...	...	...	...
XXXVII.	Loch Broom	1.62	...	.34	14	16	...	...	...	...	...	...
XXXVIII.	Helmsdale	1.52	...	.26	26	19	...	...	...	...	...	...
XXXIX.	Sandwick	2.04	— 1.29	.67	11	18	57.2	4	28.8	21	4	19	
XL.	Cork	3.80	...	.60	27	17	...	...	...	...	...	...
XLI.	Waterford	5.46	+ 2.57	1.34	11	26	59.0	16	28.0	26	4	...	
XLII.	Killaloe	2.92	— 1.40	.81	11	22	66.0	31	26.0	26	7	...	
XLIII.	Portarlinton	2.44	— .87	.37	12	27	57.0	16	27.0	20	9	...	
XLIV.	Monkstown	2.16	— .42	.57	27	20	62.0	16	27.0	26	5	5	
XLV.	Galway	2.72	...	.47	28	20	57.0	30	28.0	26¶	5	...
XLVI.	Bunninadden (Doo Castle)	4.70	...	2.08	29	16	47.0	22	23.0	24	3	...	
XLVII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	2.06	...	.35	11	17	61.0	7, 30	24.0	25	10	14
XLIX.	Strabane (Leckpatrick)	3.49	...	.75	30	21	...	...	...	...	...	...

* And 28. † And 5, 29, 30. ‡ And 16. § And 25. || And 26. ¶ And 27.

+ 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.

LINTON PARK.—First 20 days very mild and fine, next 7 very winterly, the ground being covered with snow on 21st and 22nd; last 4 days wet; there have been 11 frosty days, the sharpest on 21st and 26th. Bar. highest on 10th, being 30·06, and lowest on 30th, 28·95. Winds S. and S.W. the early part of the month, but more changeable afterwards; it was, however, S.W. on 21st; highest wind on 28th, but not remarkably so; there has been less wind than usual in March.

SELBORNE.—Prevailing wind first half of the month and last week, S.W.; third week, N.W. and N.E.; frequent white frosts; tempestuous night on 27th.

HITCHIN.—Snow on 22nd, yielding ·58 in.

BANBURY.—Exceedingly dark at 1.45 p.m. on 22nd, during snow storm; H on 18th; S on 21st, 22nd, 23rd, and 24th; ball snow on the 21st.

CULFORD.—The weather up to the 20th, mild and genial; on the 17th, the temp. was 60° in the shade; hail fell frequently during the day of 20th, and the night temp. fell to 23°, and S fell more or less on each of the six succeeding days, accompanied by a very low temp. A favourable change took place on the 27th. E. winds during 16 days and W. on 15. The mean temp. of the month has been but slightly in excess of that of the preceding month, being 44° to 43°·5.

BRIDPORT.—S.W. gale on 27th and 28th. L on the evening of 24th. Ice a quarter of an inch thick on the 22nd and 26th. Mild for the first 18 days, then cold for a week, with a little snow and sleet. Chesnuts in leaf at the end of month.

BODMIN.—Average of bar. 29·80; average temp. 46°·6, or 2°·2 above the average. The rainfall again much above the average of the past 23 years, and the fall since Jan. 1st amounts to no less than 25·65 in., which is far beyond the rainfall of any consecutive three months ever recorded here.

CIRENCESTER.—S on 21st and 23rd, and on those days and the 22nd hard frosts.

HAUGHTON HALL.—This month by no means "came in like a lion," but opened mildly with S.W. winds; on the 5th they turned to S.E., though little reducing the temp., which continued the same with little interruption till the 17th, when heavy R fell with cold wind from N.W. and an inch of S that night; from thence to the 28th it was cold and ungenial, with slight frost every night; R then set in again and continued daily to the close. A remarkable absence of high winds, not even equinoctial gales. Farmers greatly behind in getting in their Lent grain, owing to the saturated soil, but vegetation about 10 days forward. Rooks began to build, and large humble bee seen on the 4th, chaffinch sings and celandine flowers on 5th, willow blossoms on 10th, chiffchaff heard on 30th, wild cherry blossoms on 31st.

ORLETON.—Generally warm, with a few bright days and occasional falls of R till the 20th, then very cold, with severe frosts and slight falls of S, till the 27th; very rainy and warm after. The mean temp. of the whole month about 3° above the average; fogs frequent at the beginning of the month; rough winds on 18th and 21st; L seen at night on 30th. The longest continuance of R ever remembered, between the 17th of Dec. and 2nd of April, 13·92 inches of R has fallen; the average yearly fall is about 30 in.

WIGSTON.—The first half of the month was mild and growing. On the 13th a change of wind to the northward brought a week of cold winterly weather, with slight snow storms on 5 or 6 days.

BOSTON.—Heavy snow storm on 21st, snow 7 in. deep on the ground. Gale at night on 27th. S daily from 19th to 24th inclusive.

KILLINGHOLME.—The first half of the month very dry, the last very wet, with bar. unusually low, and the wind much inclined to back. Rooks building on 3rd. Apricot began to flower on 9th; 18th to 28th a cold period, with S almost daily.

DERBY.—The first half of the month beautifully fine and mild, and vegetation progressed above its average, but about the 19th a sudden change took place and the latter half of the month was as cold and disagreeable as the former was pleasant; on the 26th the ther. 5 ft. from the ground registered 26°, which is the lowest point recorded since Dec. 12th, 1871.

MANCHESTER.—Very large lunar halo on 19th ; S on 21st, 22nd, and 26th.

YORK.—Solar halo on 14th, L on 28th, S from 19th to 27th.

NORTH SHIELDS.—Solar halo on 11th and 26th ; distant lunar halo on 17th ; fog on 5th.

SEATHWAITE.—S on tops of hills on 14th ; S showers on 23rd, 24th, 25th, 26th, and 27th.

W A L E S.

HAVERFORDWEST.—Temp. above the average, except from the 20th to the 26th, when it was below ; some snow fell during that period ; the month ended excessively wet, 2·07 in. of rain fell in 23 hours, one continuous fall.

CEFNFAES.—From 21st to 30th, wintry weather, and many snow storms with occasional T and vivid L ; wind generally N.E. or S.E.

LLANDUDNO.—Sweet briar in full leaf on 5th, damson in blossom on 6th, apricot blossom quite set for fruit on 7th, swallows first seen on the 8th, jargonelle pear in full bloom on 9th. Snow on all the hills on the 21st, and very cold, frequent S and H between 21st and 27th.

S C O T L A N D.

DUMFRIES.—The general characteristic of the month has been wet ; in the first week there were three fine days ; from thence to the 19th rainy with occasional frost on grass, from 19th to 26th frosty with occasional snow showers, the last week showery, rainfall above the average. Mean temp. 43°·6. Plum and pear trees in bloom, and vegetation unusually forward.

SILVERBUT HALL, HAWICK.—Beautiful weather up to the 18th, when cold easterly winds with hard frost and heavy snow showers set in and continued up to the 27th, the ther. 27° and 0·89 in. of melted snow was measured during the 9 days. Pear, apricot, and other early fruit tree blossom is hopelessly destroyed ; such a heavy fall of snow in March has not been witnessed here since 1837.

AUCHENDRANE.—Solar radiation very strong, and but a small rainfall ; the month must have been a drying as well as a warm month and yet but very little 'March dust' was seen, and neither the soil nor the rivers have recovered from the rains of January and February. Both wind and cloud were below the average for March, the wind only once reached the force of 4 ; snow and hail showers were trifling ; the heavy storms so damaging on the eastern coast never reached this district, and the vernal equinox (the 21st) passed without any particular disturbance.

CASTLE TOWARD.—Rain less by 1·02 in. than in February ; the prevailing winds from the 1st to the 20th were S. and S.E. and from the 21st to the end cold E. winds ; on 26th, 27th, and 28th, we had very hard frosts. On the 9th, the hills were covered with snow, and on the 11th a heavy flood, on 12th T in S.W. followed by L and heavy showers, and on the 13th gooseberry bushes in full flower. Taken as a whole, this has been a better month than the last.

NOOKTON.—Snow or hail daily from 19th to 26th.

DEANSTON.—Excepting 10 days at the beginning of the month the weather was dull, cold and wet, some smart frost on the 20th, 21st, 22nd, 26th, and 27th, and snow and sleet showers without snow remaining on ground.

ABERDEEN.—A month of mild weather, notwithstanding the storm of 19th to 26th. Estimated pressure of wind less than the average.

CULLODEN.—Apricot in blossom by 10th, peach 15th, plums and pears 28th, horse chesnut, plane and larch in leaf, and elm in flower, by 28th ; oats and rye sown on 14th, potatoes planted on 27th.

PORTREE.—Very cold, with frost, snow, and sleet ; prevailing wind from N. to N.E. Garden shrubs and berry bushes blackened with frost. A strong gale on the 18th, from the west. Snow lying about 6 inches deep on high ground.

LOCHBROOM.—This month has even exceeded its predecessor in mildness and openness. Stock was never so sound and strong before at this time of the year, and field works are as far advanced as the farmer could wish ; such a fine winter and spring has not been experienced by any one living in this district.

SANDWICK.—The weather was remarkably mild, while southerly winds prevailed to the 18th, on which day the wind changed towards the N. and so continued during the remainder of the month, with occasional falls of snow. There were gales of 40 miles an hour on 2nd, 3rd, and 27th. Aurora on 13 nights.

I R E L A N D.

WATERFORD.—Splendid meteor at 8.30 p.m., on 7th, compared by some to a fire balloon. Snow occasionally from 21st to 26th.

MONKSTOWN.—Early part of the month, fine and mild; latter, cold and wet. Mean temp. of month $44^{\circ}\cdot 3$. Mean temp., 21st to 27th inclusive $36^{\circ}\cdot 8$.

DOO CASTLE.—Gale on 8th; some nights of severe frost, an evening of snow, and fearfully heavy rain, are the characteristics of this month; for on the evening of the 29th (Good Friday) the most tremendous rain ever experienced in this locality came pouring down; small streams became roaring torrents, houses became flooded, and small lakes appeared in the driest land. I regret to have to add, the loss of a valuable life within 8 miles of this place from this sudden downpour.

WARINGSTOWN.—A very disagreeable month, though the mean temp. was above the average, there was much cold weather, rainfall about the average, labor in general very backward.

UNDERGROUND TEMPERATURE.

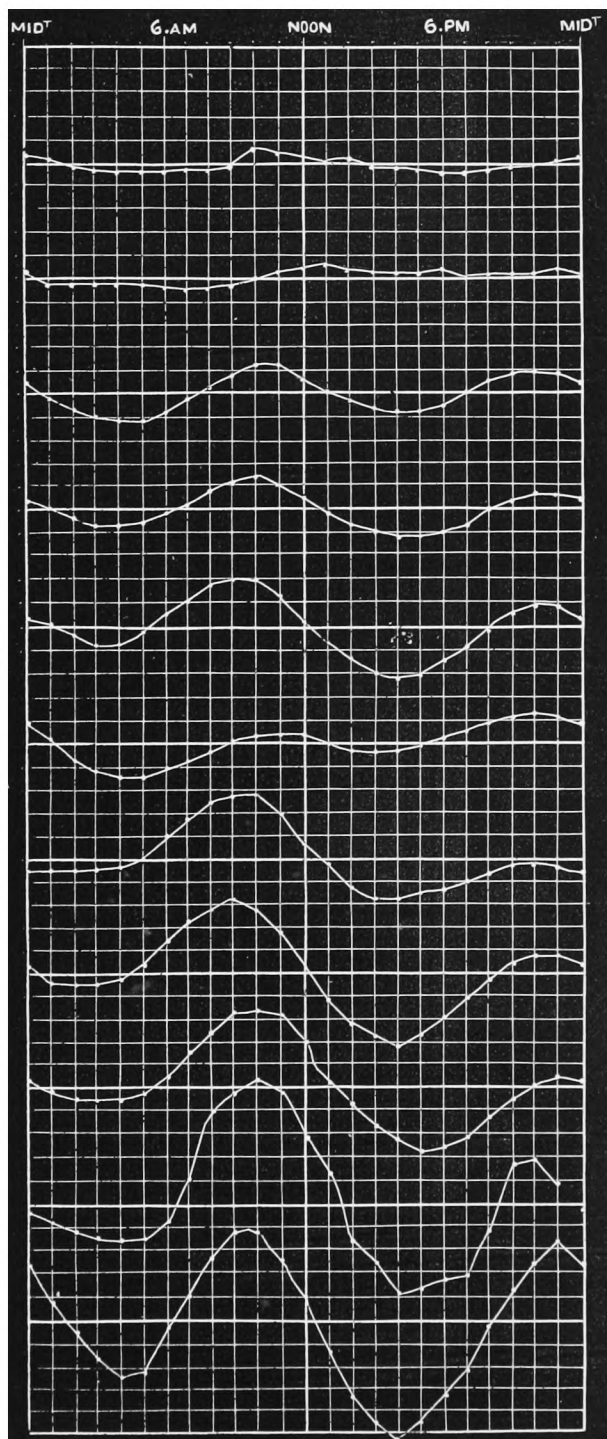
To the Editor of the Meteorological Magazine.

SIR,—In No. LXX. of the *Meteorological Magazine*, you did me the honour to insert a question on this subject. The only notice of it which you have since admitted to your pages, was from Mr. F. R. Hawkes-Mason, in No. LXXII., with arguments in favour of my hypothesis. If you will now allow me, I shall be glad to say a word or two to your readers, many of whom are probably as much interested in the phenomena of the earth, as they are in that of the atmosphere, knowing how closely the two elements are connected. It is constantly asserted that an internal, eternal fire, within the earth, causes all our volcanic phenomena, and radiates heat through the earth; so that, although it is not perceived within fifty or sixty feet of the surface, our wells and mines below that depth, give an increasing heat with depth. I have denied this cause of earthly external phenomena in "*The Interior of the Earth*," nearly two years since, without opposition, but it is constantly repeated to the world as if it were a fact. My hypothesis is, that *all heat in the earth arises from the stratum where it exists*. Man finds heat in the earth increasing with depth irregularly. That depth has never yet gone below deposits; all deposits were laid upon the sea bottom; the sea bottom is cold; there is no reason why a deposit should extract heat from a cold place; every deposit, being wholly or partly composed of earth's produce, must contain within it heating causes, and every deposit beneath other deposits must be liable to pressure. Materials are collected from deposits producing spontaneous or artificial combustion; water can be boiled, and matter can be ignited in air, by pressure; mechanical and chemical arrangements, therefore, produce heat. Both of these arrangements exist beneath our feet; heat and fire can therefore be produced in deposits. Man has never yet measured these deposits, yet he has had the temerity to say that the deposits are unequal to the results. The whole earth, from its surface to that which was once the water bottom, is all deposit, either of void primary matter, or of earth's production. Deposits must therefore be adequate to the phenomena produced by them, consequently each deposit, chemically or mechanically, or with both combined, produces its own heat, and its own phenomena.—Yours, &c.,

H. P. MALET.

Nettlebed, Oxon.

DIURNAL OSCILLATION OF THE BAROMETER IN VARIOUS LATITUDES.



Sitka	57° 0'
St. Petersburg.	59° 56'
Greenwich	51° 28'
Halle	51° 28'
Geneva.....	46° 13'
Grt. St. Bernard	45° 50'
Toronto	43° 38'
Philadelphia ...	39° 56'
San Francisco...	37° 48'
Calcutta	22° 35'
Cumana	10° 27'

NOTE.—The distance between each two horizontal lines represents 0.01 inch, thus at Sitka the reading at 10 a.m. is 0.008 inch above the mean.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

LXXVI.]

MAY, 1872.

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ANOTHER METEOROLOGICAL CONGRESS.

(Continued from page 40.)

RESUMING our notice of Dr. Ballot's excellent *Suggestions*, which we hope by this time is in the hands of all our readers, we have to consider the section devoted to Barometer Readings. Here again the doctor states that the combination of observations made at 6 a.m., 2 p.m., and 10 p.m., "is acceptable, for it gives very nearly the afternoon minimum and evening maximum, though 8 a.m., 4 p.m., and midnight would in this case certainly be better. From both the average of the day is nearly known, but with respect to the barometer, it is not for this reason that I propose such a combination." He then goes on to state his objections to the publication of mean daily values with a copiousness and energy with which we cordially sympathize.

It is possible that some of our readers are not familiar with the amount and period of the daily barometric oscillation to which reference is above made, in the terms "afternoon minimum and evening maximum." We, therefore, before proceeding further, interpose a few remarks upon the subject. We think that many writers have attached undue importance to the daily oscillation of the barometer. There are certain special enquiries, such for instance as barometric determination of heights, in which even these small oscillations are of importance, and singularly enough they are precisely the enquiries in which hitherto daily oscillation has been entirely ignored, while in starting observations for the determination of the great laws of atmospheric movement, daily oscillation is constantly referred to, although in that case we are not dealing with small distances, but with areas of thousands of miles in extent, we are not dealing with differences of barometric readings of 1000ths of an inch, but with inches, or at least with tenths. For such enquiries, what can be the importance of a possible error of, in these latitudes, about one-hundredth of an inch, or the equivalent of a barometer being removed one story higher or lower in the observer's house. Far be it from us to encourage carelessness or slippery work, but on the other hand let us not by striving after theoretical perfection, run the risk of disheartening observers, and losing them altogether by imposing hours of observation irksome or inconvenient,

when other hours would give information as precise as we can ever utilize. The plate which forms the frontispiece to this number, shows the character of this daily oscillation in various latitudes, both in the Old and New Worlds, from Cumana on the north coast of South America, to Sitka on the north-west of North America, and from Calcutta to St. Petersburg. There is one fact connected with the plate to which the strongest attention must be drawn—the real amount of oscillation is so small, that it has been necessary, in order to render its details visible, to represent it *ten times greater than it really is*. It will be seen that although the amplitude of the oscillation varies greatly, from about 0·010 at Sitka to nearly 0·100 at Cumana, its epochs of max. and min. are similar at all the stations quoted except two—St. Petersburg and at the Monastery on the Great St. Bernard. The oscillation at St. Petersburg is so very small, never amounting to 0·010 either plus or minus, that its departure from the normal form is not perhaps to be wondered at. The changed form at St. Bernard arises from its great altitude (8,127 ft.), for a similar curve with only one maximum and one minimum in each twenty-four hours has been observed at the more lofty stations in Central Asia (*e.g.*, at Leh, 11,532 ft. above sea level, and at Fütüt, 11,838 ft.) The times of maximum and minimum are easily remembered, they may be taken as 10 and 4, *i.e.*, 10 a.m. and 10 p.m. for the two maxima, and 4 a.m. and 4 p.m. for the two minima, the actual time being rather before those hours in the morning and after them in the afternoon.

Having refreshed our readers' memories with these facts, let us now return to Dr. Ballot's remarks.

It is quite true that observations at 6 a.m., 2 p.m., and 10 p.m., give very nearly the true mean of the day; they do so within 0·001 in., and it is equally true that 8 a.m., 4 p.m., and midnight are better, for they give it within 0·0002 in., only that no barometer will show so small a quantity,—but for *all* purposes one plan is as good as the other. We submit that the extent of oscillation is so small, its amount so well known, and if not, so easily ascertained by Col. Williamson's method, that it should be excluded from consideration when deciding upon hours of observation.

We heartily agree with Dr. Ballot in his onslaught upon the publication of the "Mean daily height of the Barometer," to the exclusion of its observed height at definite hours. The former is absolutely useless for chartographic meteorology, while the latter is its most essential requirement. Although we could add much to what Dr. Ballot has so well written upon this point, we scarcely think it can be necessary, especially as the faulty method has but few supporters.

The next branch of the subject is commenced with the following words, which puzzle us :—

"Some may be inclined to reduce the observations not only [¹for temperature,] and [²rectify certain known faults in the instrument, for capacity and capillarity], but likewise for [³the height at which it is placed above the sea.] The first is necessary, the second is of no moment, the last is not allowable."

We have inserted the brackets and numerals in order to guard against mistake, and we hope that we have placed them where the author himself would have done. If so, we are forced to the conclusion that Dr. Ballot considers corrections for instrumental errors, for capacity and capillarity, of no moment. Surely this cannot be. The aggregate amount of these errors (all of which can be accurately determined) may be fifty-fold that produceable by daily oscillation, and should therefore apparently receive fifty-fold as much consideration. And even supposing that the expression refers to the utilization of the observations for publication as departures, there remains this difficulty, that the amount of departure depends upon the capacity correction of the barometer. We cannot understand how useful results are to be obtained from barometers requiring correction for capacity until that correction has been applied. We are glad to remark that in our own country that construction of barometer has long been abandoned. The third point, correction for height above sea level, is a difficult one—too complex for discussion here. Dr. Ballot has evidently given considerable attention to the subject, and says in the most decided manner that correction for this disturbing cause is not allowable. Our own opinion on this point is different, but not having the large experience of Dr. Ballot, we have no desire to press it; but we certainly should like to see the evidence which has led him to the conclusion, and we think that before it is accepted it would be desirable to ascertain the opinion of men accustomed to the use of the barometer for surveying purposes. No one has carried this branch of investigation to such a degree of perfection as Colonel Williamson, his opinion would therefore be most valuable; while among others specially qualified to guide us in this matter we should at once name Prof. A. D. Bache, Prof. Arnold Guyot, and among our own countrymen, Messrs. A. J. Ellis and F. F. Tuckett.

Dr. Ballot concludes his remarks on Barometric Readings with the suggestion that the alteration in gravity (due to the difference between the polar and equatorial diameter of the earth), should be taken into account. This is very easily done, but we should have thought it would be sufficient to apply it finally to mean results, instead of primarily along with the temperature correction.

ACCIDENTS FROM LIGHTNING.

THE thunderstorms of the last week in April and the early part of May appear to have been unusually destructive. Several instances will be found in the remarks of our regular correspondents, and the following are others. We wish our readers more generally recognised the importance of collecting such notices, and forwarding them to us. We believe that there is much to be learned from the geographical distribution of thunderstorms, and the *locale* as well as the character of the mechanical effects of lightning.

YORKSHIRE.—*To the Editor of the Times.* Sir,—Nostell Priory is a large house, the residence of Mr. Charles Winn. The house is five miles from Wakefield,

On Wednesday last, the 17th of April, at about 6 p.m., a stack of chimneys was struck by lightning. The stack is built of extremely strong stone work, the top of it being more than 50 feet from the ground. The lightning seems to have entered two contiguous chimneys, divided by a thin partition. This thin partition was untouched, but the stone work of each chimney, nearly a foot in thickness, was completely shattered and blown out, leaving a hole in each chimney nearly big enough for a wheelbarrow to enter. Stones bigger than a man's head were blown out horizontally, first over 25 feet of roof, and then over a flight of steps extending more than 20 feet from the wall of the house. Thus, they were thrown nearly 50 feet from the chimney into the carriage road below. A thunder-clap was heard at the same moment, like the report of a cannon. No trace of the electric fluid can be observed lower down in the chimney than the fracture I have described. I read in the newspapers that almost at the same hour of the same day injury was done at Leeds by lightning. I am, Sir, your obedient servant,

Nostell Priory, April 21.

H. STRICKLAND CONSTABLE.

LANCASHIRE.—The storms of Wednesday and Thursday, the 24th and 25th April, seem to have been very severe in many parts of the north of England. At Upholland Moss, near Wigan, a woman, about 39 years of age, named Moss, was killed instantaneously while she was walking on the highway. At Pemberton the lightning did considerable damage to a long row of cottages known as Victoria-street. It would appear that, having struck one of the houses, it ran to the end of the street, where it threw down a stack of chimneys, and then entering a cottage it forced out the windows of the rooms at the front and made sad havoc with the furniture. At Adlington the lightning struck a stone cross on the top of St. Joseph's Roman Catholic Chapel, hurling large blocks of stone to the ground and on to the adjoining building, in which about 12 masons had taken shelter. One stone, weighing about two hundredweight, penetrated the slates and hung suspended above the heads of the men. Mr. Simmons, contractor, of Chorley, who was close by, giving orders, experienced a severe electric shock. The cross and saddle stone, weighing about five hundredweight fell through the roof of the entrance porch to the chapel. A cottage in the yard of the Adlington Gas Company was also struck by lightning and much damaged. Several houses in Hulme-street, Bolton, were also struck. In one, the tenants, John Noble and his wife, were both stunned, while the woman was blinded for a short time. A woman named Maria Compton, was also struck on the arm, but was not much hurt. During the thunderstorm of Thursday the ship *Faillie*, lying in the Alfred Dock, Birkenhead, was struck by lightning, the mainmast head being snapped off at the rigging. In the Nelson Dock, Liverpool, the *King of the Belgians*, screw steamer, was also struck by lightning, and splinters of the masthead spar were scattered about the deck of the vessel.

LONDON.—Yesterday, about noon, May 7th, a short but severe thunderstorm broke over the metropolis. The lightning did some mischief to the telegraph wires; in Fleet-street one was cut in two. The bells of the fire brigade telegraphs, too, constantly rang, to the annoyance of the firemen. The wind was so high that even the above-bridge steamboats had great difficulty in making way against the tide. At Deptford the lightning struck a house in Seymour-place, dislodging a portion of the roof, entering a back room, breaking a mirror, and nearly injuring a mother and child.

NORFOLK.—On Tuesday last, May 7th, a violent thunderstorm occurred at Wymondham. The electric fluid passed down the chimney of Superintendent Barrett's house, and ignited some sacking placed there to prevent soot from falling into the room. The superintendent's family were absent from home, and a person sitting in the magistrates' room opposite, fortunately noticed a cloud of smoke issuing from the front of the house. Mr. Barrett, with the assistance of Wm. Bunn, soon succeeded in extinguishing the fire, but had it not been discovered, in a few minutes some woodwork in the vicinity would have spread the fire, and the damage resulting must have been serious.

ESSEX.—The parish church of Mashbury, Essex, has been struck by lightning and set on fire. The spire and belfry, which were of wood, soon succumbed to the flames, which, fanned by a strong wind, travelled eastward along the roof

of the nave, feeding on the timbers between the plastering and the tiles. A messenger was despatched to Chelmsford for the Essex and Suffolk Equitable fire-engine, which was got to the scene of the disaster as quickly as possible. An opening in the plaster work was made, and the fire was beaten back, so as to preserve the chancel (the only portion insured) intact. The roof of the nave is destroyed, and some of the fittings damaged by falling *débris*, the damage being estimated at about £200.

LINCOLNSHIRE.—A terrific thunderstorm passed over Great Grimsby and its vicinity on Wednesday afternoon, May 8th. At Great Coates, Robert Webster, aged 30, a farm labourer, in the employ of Mr. John Garniss, was killed by the lightning. He was engaged at the time in harrowing with a three-horse team. All the horses were knocked down and the centre horse was killed. Deceased's left arm and neck were broken, and his body fearfully lacerated and burnt. His clothes were ripped off, and bits were picked up twelve yards away. The shock was felt by other men working in the field, and a horse belonging to a second team was also struck down. The harrows appear to have attracted the lightning, which during its greatest intensity was unaccompanied by rain. During the time the storm lasted—namely, for nearly an hour—everything was shrouded in comparative darkness.

DEVON.—A tremendous storm passed over Bampton yesterday, accompanied with hail. At 12.35 the lightning struck the spire of the parish church, where five iron clamps are fixed, which is about 180 feet high. The fluid displaced 10 courses of stonework on the northern side, or about 15 feet; it also split the spire on the south side. The fluid apparently passed over the bells, destroying the wires connecting the chimes with the clock. It is supposed about 40 feet will have to be rebuilt. Several trees in the neighbourhood have been struck.

SURREY.—*To the Editor of the Times.* Sir,—As I was walking across Wimbledon common this afternoon at 20 minutes past 5 o'clock, in the midst of a deluge of rain, I suddenly received an electric shock in the left temple. I was carrying overhead an umbrella with an iron frame and wooden handle. A ring of sparks crackled from the extremities of the iron spokes, while almost instantaneously there broke immediately above a terrific peal of thunder. These facts may be of interest to some students of electricity.

GEORGE WYLD, M.D.

12, Great Cumberland-place, May 9.

OZONE.

To the Editor of the Meteorological Magazine.

SIR,—In the *Annalen der Chemie und Pharmacie*, for February and March, 1872, is an able paper by Dr. E. von Gorup-Besanez, on the Ozone Reaction of the Air in the neighbourhood of the Gradirhäuser, at Kissingen.

The author shows that the air near these places is popularly likened to sea air from its peculiar fresh smell, and finds this confirmed by ozone papers, which there gave higher numbers than similar ones exposed near his house at Kissingen. He gives careful chemical proof that ozone alone caused the colouration of the papers, and infers that this was due to the effect on the air of the finely-divided water spray with which these houses are filled. Further, the salt is not in question in the reaction, as similar results were obtained in experiments on finely-divided water spray in the Botanic Gardens.—Yours, truly,

W. D. HOWARD.

Tottenham.

DECREASE OF RAIN WITH ELEVATION.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Crallan has called the attention of your correspondents to a theory advanced by Mr. Parnell, in the December number of the *Meteorological Magazine*, in explanation of altitude-difference of rainfall. Mr. Parnell states that altitude-difference of rainfall *must* result in the case of a shower driven by a north wind passing, in its descent, into a N.E. current: that the most easterly layer of drops is influenced by the N.E. wind to a *greater* extent than each more westerly layer. I cannot see any ground for this assumption, since each layer of drops, from the east to the west edge of the shower, falls into the N.E. current at the same moment, and the wind is blowing with the same force at the westerly as at the easterly edge; consequently, all the layers of drops are influenced in exactly the same degree: indeed, should a shower in its descent pass successively into four different currents of wind—north, south, east, and west—I see no reason why the *position* of the drops, *inter se*, in a horizontal plane should be altered. The path of any drop (the density of all being supposed equal) would be curved, and its direction altered, in a line exactly parallel with the path of its neighbours. I do not find in Mr. Parnell's theory, the explanation of this most puzzling feature of rainfall.—Yours truly,

G. WARREN.

Merton Villa, Cambridge, April 26th, 1872.

REVIEWS.

Stonyhurst College Observatory. Results of Meteorological and Magnetical Observations, 1871. By REV. S. J. PERRY. Preston: J. Robinson. Small 8vo., 41 pp.

THIS useful annual, in addition to the ordinary matter which we have often described, contains several extra details of general interest. The first, is the following complete account of the earthquake of March 17th, 1871:—

“On the 17th, a shock of earthquake was felt throughout the whole country around. It was more severe than any that had been experienced for many years past in this part of England. Slight shocks appear to have been noticed here at about 6.30 and 10.30 p.m., but the greatest disturbance occurred between 11.5 and 11.10 p.m. The sound preceding the undulatory motion is described by most as resembling that of a strong wind, followed immediately by a noise like that caused by the passage of an express train over a wooden bridge. Then a very distinct rocking of the furniture, beds, and walls took place; the floors seemed to rise; and the rooms swayed backwards and forwards several times. The motion was violent enough to awaken many from their first sleep. Some thought that part of the building had fallen in, and others that something heavy had been upset in a room overhead. The rushing sound and crash was followed by a rumbling noise. The motion appeared to begin suddenly, to grow stronger for a time, and then to die away. It was more regular and powerful than the shaking from a heavy waggon in the houses of an old street. The disturbance was, however, insufficient to produce any decided irregularity in our photographic traces of the barometer, thermometer, or suspended magnets, except perhaps a very slight movement of the declination magnet. But in any case the duration of the whole phenomenon,

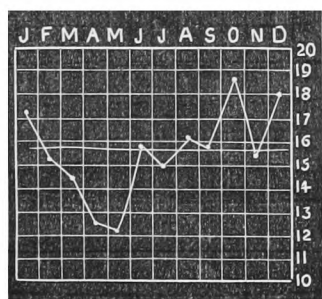
which must have occupied far less than half a minute, could easily have caused a slight blur in the photographic curve. Between 11 and 11.15 p.m., the sky, which both before and after the earthquake was completely overcast, suddenly cleared up for a very short time, and there was a decided rise of the temperature. The direction of the earthwave was generally supposed to be from E. to W., the wind blowing at the time from W.S.W."

The next special feature is a table showing the number of days in each month from 1848 to 1871, both inclusive, on which the fall of rain was at least 0.01 inch. Instead of transferring the table to our pages, we have drawn up the following abstract:—

Days on which 0.01 in. or more of Rain fell.

	Mean.		Max.		Min.		Mean.		Max.		Min.
January.....	17.3	...	27	...	7	July	15.0	...	26	...	8
February ...	15.2	...	23	...	4	August ...	16.1	...	26	...	7
March	14.4	...	26	...	2	September...	15.7	...	26	...	5
April	12.8	...	22	...	3	October	18.6	...	25	...	4
May	12.3	...	21	...	4	November...	15.4	...	26	...	6
June	15.8	...	25	...	4	December ...	18.0	...	27	...	7

These mean values are shown in the following diagram, whence the



lateness of the minimum, occurring in May, is very evident. The curve also shows that at Stonyhurst the frequency curve is very similar to that which Mr. Gaster's investigations would lead us to assume must be the quantity curve. The total number of days per annum ranges from 134 in 1855 to 234 in 1863, and averages 187, or, to put it shortly, it usually rains at Stonyhurst on half the days in the year.

The third extra article is on the comparison of the two sets of thermometric observations during the years 1868–1871. It is not a comparison of thermometer stands, *per se*, but of the ultimate result of two methods of observation. It is a comparison between the *mean daily temperature* as deduced from (1) a dry bulb thermometer on a Glaisher stand, read at 9 a.m. and 9 p.m., corrected for daily range by Glaisher's tables, and of the maximum and minimum thermometers, also corrected by the same tables, and (2) the mean of 24 hourly measures per diem of the thermograms, recording photographically the temperature, in a modified Kew thermometer stand.

Correcting an obvious misprint of 46°68 for the mean temperature of 1871 to 46°88, its proper value, we have for the mean of the four years by the first, or ordinary method, 47°55, and by the second, or

photographic, 47°34'. The difference (only two-tenths of a degree) is so small as to be very possibly due to shifting of the zero point in the older thermometers. Nothing is said about index error, but we think it possible that the corrections originally supplied with the instruments may have been used, and, if so, that on re-comparison with a standard it may be found that the index errors have altered. If this explanation is inadmissible, we should look for the source of this trifling difference in the fact that the thermograph bulbs are only 2 ft. 3 in. from the wall of the observatory, and that possibly warmth from the building, or from the lamps required to obtain their indications, reaches the bulbs. At any rate, it is satisfactory to find so small a difference, and to learn that two good eye observations per diem will give the mean annual temperature almost as accurately as a thermograph costing a hundred times as much money, and requiring mechanical skill in manipulation, photographic skill in preparing and developing the thermograms, and mental skill in reading off the curves and tabulating the results.

Sixth Annual Report on the Sanitary Condition of Merthyr-Tydfil.

By T. J. DYKE, F.R.C.S., &c. Merthyr: Farrant and Frost. 8vo., 38 pp.

WE are glad to find Mr. Dyke continuing his reports, and keeping them up to the high level of completeness and accuracy which we have had to notice on previous occasions. One very important subject seems to have accidentally escaped recognition this year—the quantity and quality of the water supply. The meteorological notes possess their usual completeness, but we should like a few tabular values: as Mr. Dyke evidently takes his observations with regularity, a brief tabular summary could easily be compiled, and would be a welcome addition.

Jahrbucher der K. K. Central-Anstalt für Meteorologie und Erdmagnetismus. Von CARL JELINEK und CARL FRITSCH. Neue folge VI. Band Jahrgang, 1869. Vienna, 1871. Wilhelm Braumüller. Quarto. 278 pp., one plate.

THIS excellent publication maintains its character for completeness and efficiency, but we regret to see that no great progress has yet been made towards ensuring synchronous observations among the 163 contributors of observations. The most usual hours seem to be six or seven a.m., two p.m., and nine or ten p.m., but not only are these hours not universal, but many of the observers vary them according to the season of the year.

In the introduction, very full information is given as to the various changes in the stations and observers, as to determination of their heights above sea-level, and as to the errors of the various barometers. The usual Austrian daily weather reports occupy the first 96 pages, and are followed by the abstracts of temperature, mean max, and min. With respect to the two latter elements setting an example,

which (although adopted in our own pages) we venture to assert the Meteorological Societies of this country would do well to follow. The Austrians not only give the extremes of temperature but also the *dates on which they occur*.

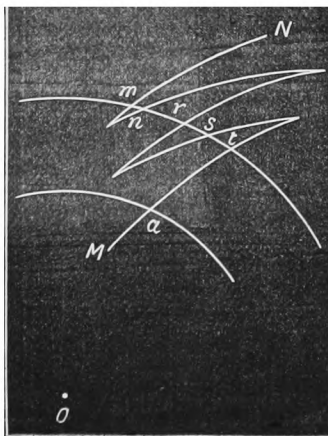
As to pressure we almost wish that the tables were given in duplicate, the sea-level equivalents being tabulated for each station. The rainfall and amount of cloud tables call for no special comment, but the excellent plan of giving *not* the number of observations, but the *per centage of frequency* of each wind at each station in each month is another point worth copying.

The remainder of the volume is principally devoted to results of ground thermometers, magnetic observations, and a very complete and well-arranged Natural History calendar,—not only superior to anything carried out in this country, but even to anything attempted. We commend this indisputable fact to the consideration of British naturalists.

Deschanel's Natural Philosophy. By Prof. EVERETT, D.C.L., F.R.S.E., Part III., Electricity and Magnetism. Large 8vo, 278 pp., one plate, and 241 engravings. Blackie and Sons.

THE general excellence of this translation is fully maintained in this third part, perhaps slightly increased by the translator's own researches in several branches of the subjects discussed. This is especially the case with respect to the amount and character of annual and diurnal variations, in atmospheric electricity, of the results of which Professor Everett gives a very able summary. We only notice one paragraph which we do not consider altogether satisfactory, namely, the following:—

"476. THUNDER.—Thunder frequently consists of a number of reports heard in succession. This can be explained by supposing that (as in the experiment of the spangled tube, § 440), discharge occurs at several places at once. The reports of these explosions will be heard in the order of their distance from the observer. If, for example, the lines of discharge form the zig-zag *m n* (fig. 404), an observer at *o* will hear first the explosion at *a*, then, a little later, the five explosions at *m*, *n*, *r*, *s*, *t*; he will consequently observe an increase in the intensity of the sound."



Without entering on the question of the reality or otherwise of such zig-zag flashes as the one here figured, we think it rather strange that the influence of clouds and hills in producing the reverberation of thunder is wholly ignored. Those who have been close to objects struck by lightning are familiar with the fact that in such cases the thunder is not a peal but a single bang. Those resident in hilly districts, or who have been caught in thunderstorms on the Alps, or in other mountain chains, are equally aware how the thunder echoes and re-echoes from side to side, until the reverberation of one peal is merged in its successor. And, lastly, we think it is matter of experience with most meteorologists, that a single straight downstroke of lightning is often followed by a peal of thunder of greater length than a flash of more sinuous character. As to a zig-zag, such as is shown in the engraving, never having seen such a flash, we have no knowledge of what kind of thunder might follow.

As we have already said, we highly approve of the work ; we believe that it is destined to take a permanent place as an English textbook, and we have no doubt that now that Prof. Everett's attention has been directed to this single paragraph, he will, in the next edition, make it more worthy of the context, and of the trustworthy and well got-up work in which it appears.

The Normal Winds of Bombay. BY C. CHAMBERS, F.R.S., Superintendent, Government Observatory, Colaba. Small folio, 9 pp., 10 plates. [Extract from the *Bombay Builder*, June and August, 1869.]

THESE articles well merited republication in the separate form in which they are now before us. The instrument (the Beckley-Robinson anemograph) is fully described, with a few words as to certain modifications adopted at Colaba. After explaining that the observations are resolved into their N.—S. and E.—W. components, Mr. Chambers proceeds to explain the large series of diagrams with which the paper terminates, most of which are on an ingenious plan which is new to us, and for the explanation and illustration of which we refer our readers to the paper itself. The following paragraph puts the relative arguments for the publication of velocity and of pressure so clearly, that we transfer it *in extenso* :—

“The force of this wind has been measured by its velocity rather than by its pressure, because, to the meteorologist, the chief significance of wind lies in the interchange of meteorological conditions that result from the transfer of bodies of air from districts in certain conditions to other districts where the conditions are different ; and the quantity or extent of motion of the air bodily is the proper measure of this transfer, the same bodily motion of the atmosphere, carrying as part of it the vitiated air of populous towns and districts and supplying its place by fresh air, pure or impure, according to the influences to which it has been subjected in its previous course, is also the relation in which the wind affects sanitation. To the engineer or builder, however, who would regulate the strength of an elevated structure to the force of the winds that would strike it, the *maximum* pressure of the wind is the proper measure. The pressure is also proportional to the effectiveness of the wind in driving a ship through the sea, and is, therefore, the mariner's natural measure. The pressure is proportional to the square of the

velocity, and, therefore, an average pressure will not be exactly the same as the pressure which corresponds to the average velocity of the same winds, but somewhat greater. Neither can one be exactly calculated from the other, but they approach nearer to each other in value the more nearly the individual winds are of equal strength. And as regards the normal winds herein treated, the pressure corresponding to the velocities may be safely used as close approximations for nautical purposes. The formula for reducing velocities (V) in miles per hour to pressure (P) in pounds on the square foot, is— $P = \frac{V^2}{200}$

200

Meteorological Observations. Climate of Brighton. A series of articles published in the *Brighton Daily News*, from September to December, 1871, by F. E. SAWYER, F.M.S. 4to., 12 pp.

The Climate of Brighton, being a Summary of Meteorological Observations made in the Town, to the end of 1870, by SAMUEL BARKER, M.D., F.M.S.; EDWIN ROWLEY, F.M.S., and FREDERICK ERNEST SAWYER, F.M.S. [Reprinted, with additions, from the *Brighton Daily News*, June, 1871.] Small 8vo., 8 pp.

Brighton Rainfall. By F. E. SAWYER, F.M.S. [From the *Brighton Herald*, of September 30th, 1871.] Small 8vo., 6 pp.

HASTINGS used to possess a local Meteorological Society, but we believe it has faded away; Bournemouth has one at the present time, but the largest of our English watering places has not. And so long as the local observers co-operate as they are now doing their incorporation as a society is immaterial—it would be little more than a change of name. The three papers now before us are mainly the work of Mr. Sawyer, and afford abundant proof of his zeal and perseverance; and the first-mentioned is in all respects (except paper and type) a good model for a treatise on local climate. It commences with notices of the physical geography of the district, its altitude, configuration and geology. The two following chapters are devoted to temperature, mean, seasonal, and extremes. The winds come next, and are treated in a very clear manner. The sea breezes are thus referred to:—

“At Brighton the most marked of the land and sea breezes are the easterly. The land breeze, N.E. or E., blows until about 11 a.m., when the sea breeze, S.E. or S. sets in until sunset, or sometimes until midnight, when the land breezes begin again. When the breezes are westerly the land breeze is from the N.W. or W. and the sea breeze from the S.W. or S., occasionally S.E. Sometimes the land breeze begins in N.E., is followed by S. or S.W. sea breeze, and then a N.W. or N. land breeze again, or the reverse way, but this is not often.”

The chapter on Rainfall is good, but not equal to the separate article mentioned at the head of this review. There are also notices of ozone, pressure, humidity, radiation, absence of trees, and the reason for it. Phenomena in connection with the periodical return of the seasons, weather proverbs and prognostications, including a few Sussex ones, *e.g.*,

“When Wolsonbury has a cap
Hurstpierpoint will have a drop.”

a south country modification of a common prognostic, of which perhaps a few other variations may be appropriately mentioned:—

" If Riving Pike do wear a hood,
Be sure the day will ne'er be good."

" When Cheviot ye see put on his cap,
Of rain ye'll have a wee bit drap."

" If Roseberry Topping wears a cap,
Let Cleveland then beware a clap."

" When Breddon Hill puts on his hat,
Ye men of the vale beware of that."

" When Largo Law puts on his hat,
Let Kellie Law beware of that ;
When Kellie Law gets on his cap
Largo Law may laugh at that."

Note—Largo Law is to the south-west of Kellie Law.

Some of these are taken from a capital collection of *Weather Lore*, by R. Inwards, which, incidentally, we recommend to our readers.

The next chapter is devoted to a chronology of remarkable phenomena from 1703 to the present time, ably compiled, and very interesting. De Foe's report on the storm of 1703, is quoted, and we repeat the quotation, as, perhaps, no greater contrast can be found than the Brighthelmstone of his day and the Brighton of our own :—

" Brighthelmstone being an old-built and poor, tho' populous town, was most miserably torn to pieces, and made the very picture of desolation, that it lookt as if an enemy had sackt it."

The work concludes with notices of the various observers in Brighton during the present and previous centuries, with a list of the works on the climate or meteorology of the town, and a comparison of the climate of Brighton with that of other parts of Sussex.

BOOKS RECEIVED.

Sussex County Lunatic Asylum, Hayward's Heath. Thirteenth Annual Report, being for the year 1871. 8vo.

Currents and Surface Temperature of the North Atlantic Ocean. 4to. Price 2/6.

Deschanel's Natural Philosophy. BY PROF. EVERETT. Large 8vo. Price 4/6.

A Sketch of the Geology of the Neighbourhood of Banbury. BY MR. THOMAS BEESLEY, F.C.S. Small 8vo.

Report of the Rugby School Natural History Society for 1871. 8vo.

Proceedings of the Literary and Philosophical Society, Manchester. Vol. XI., No. 11.

Meteorological Society of Mauritius. Monthly Notices, 1871.

AMERICAN WINTER.

It is stated that this year, for the first time within the memory of man, Lake Michigan has been frozen over as far as the eye can reach, the ice being from four to eight inches in thickness.

APRIL, 1872.

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	1.39	+	.26	.31	20	16	70.2	27	29.4	20	1	5
II.	Maidstone (Linton Park)	1.56	+	.34	.51	21	15	71.0	12+	30.0	20	4	...
	Selborne (The Wakes)	1.49	—	.01	.41	20	14	64.5	27	26.2	7	5	9
III.	Hitchen	1.88	+	.88	.40	21	15	67.0	27	26.0	19	4	...
	Banbury	2.15	+	.99	.65	27	15	69.0	12	28.5	7	5	...
IV.	Bury St. Edmunds (Culford)	1.86	+	1.11	.43	20	16	71.0	12	24.0	19	6	16
V.	Bridport	2.18	+	.70	.47	22	10	63.0	8, 14	26.0	20	6	...
"	Barnstaple	2.68	+	.67	.43	21*	13	67.5	12	32.0	20	...	...
"	Bodmin	4.58	+	2.88	1.20	21	14	63.0	14	34.0	6	...	5
VI.	Cirencester	2.37	+	1.08	.65	27	12	...	...	...	...	...	...
"	Shiffnal (Haughton Hall)	2.96	+	1.81	.79	1	13	65.0	12	31.0	3, 4	6	...
"	Tenbury (Orleton)	2.82	+	1.28	.70	27	13	70.8	12	29.8	20	3	14
VII.	Leicester (Wigston)	3.03	+	1.73	.64	28	13	75.0	12	30.0	20	3	...
"	Boston	2.71	+	1.74	1.12	2	15	73.8	12	33.8	4	...	4
"	Grimsby (Killingholme)	3.07	...	...	1.05	21	14	68.0	12	32.0	20	...	...
"	Derby	2.24	+	.81	.69	27	14	70.0	12	31.0	20	1	...
VIII.	Manchester	2.98	+	1.22	.91	2	11	70.4	12	30.0	3	3	10
IX.	York	2.81	+	1.71	.72	2	16	67.0	12	30.0	20	1	...
"	Skipton (Arncliffe)	4.44	+	1.40	1.33	22	17	...	...	...	...	...	...
"	North Shields	1.94	+	.63	.88	21	13	63.6	12	33.0	19	...	3
"	Borrowdale (Seathwaite)	5.08	—	1.82	1.48	7	13	...	...	...	...	...	...
XI.	Cardiff (Ely)	1.99	+	.06	.49	28	10	...	...	...	...	...	...
"	Haverfordwest	2.45	+	.59	.50	25	13	62.0	30	28.0	19	8	12
"	Rhayader (Cefnfaes)	3.63	+	1.74	.55	25	13	65.0	...	29.0	...	...	...
"	Llandudno	2.18	+	.68	.71	21	9	67.2	30	32.5	20	0	...
XII.	Dumfries	1.16	—	.51	.35	27	9	64.0	12	30.0	3	3	6
"	Hawick (Silverbut Hall)	3.03	...	...	.75	21	16	...	...	...	...	...	...
XIV.	Ayr (Auchendrane House) .....	.89	—	1.33	.29	7	9	60.0	12	25.0	19	5	13
XV.	Castle Toward	1.82	—	.68	.50	1	13	56.0	8	28.0	...	2	...
XVI.	Leven (Nookton)	1.75	+	.50	.40	27	11	62.0	10+	29.0	6	3	14
"	Stirling (Deanston)	1.35	—	.40	.32	25	16	62.7	10	21.0	27	6	9
"	Logierait	1.05	...	...	.29	24	9	...	...	...	...	...	...
XVII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...	...
"	Aberdeen	3.00	...	...	.62	27	18	59.9	14	33.8	19	0	14
XVIII.	Inverness (Culloden) .....	.92	...	...	.28	23	16	57.0	30	33.9	21	0	8
"	Portree	5.35	+	.08	.81	30	24	...	...	...	...	...	...
"	Loch Broom	2.83	...	...	.42	20	21	...	...	...	...	...	...
XIX.	Helmsdale	3.49	...	...	1.01	17	23	...	...	...	...	...	...
"	Sandwick	2.40	+	.66	.36	7	20	60.0	30	33.0	1	...	13
XX.	Cork	1.11	...	...	.31	20	9	...	...	...	...	...	...
"	Waterford	3.04	+	.81	.88	20	13	63.0	15	30.0	22	2	...
"	Killaloe	2.46	+	.33	.46	7	14	65.0	9‡	28.0	5	3	...
XXI.	Portarlington	2.33	+	.31	.66	22	22	62.0	10	29.5	4	4	...
"	Monkstown	2.97	+	1.33	1.20	21	11	70.0	10	30.0	5	4	...
XXII.	Galway	1.70	...	...	.35	7	12	60.0	8, 10	30.0	4	1	...
"	Bunninadden (Doo Castle)	1.16	...	...	.20	1	17	56.0	30	29.0	4	5	...
XXIII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...	...
"	Waringstown	3.05	...	...	.56	21	13	65.0	11‡	30.0	2	3	12
"	Strabane (Leckpatrick)	2.89	..	...	.57	1	22	...	...	...	...	...	...

* And 25. + And 15. ‡ And 30. § And 15, 25, 29.
 + 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.

LINTON PARK.—A remarkable but not unfavorable month; bright, warm, sunny weather generally prevailed, so that vegetation is more forward than has been the case for several years at the same period. T and L with a little R on two consecutive nights, 26th and 27th; high wind on night of 20th; ther. 7° or upwards on six days; bar. generally unsteady, and wind changeable.

SELBORNE.—Temp., wind and weather all variable; frequent frosts; fog on 5th, 11th, 20th, and 21st; heavy S on 21st; H and R on 25th; faint aurora on 10th and 11th.

BANBURY.—T, L, S, and heavy R on 21st; H on 23rd and 24th.

CULFORD.—Frost on the grass on 16 mornings; on the night of the 24th, the temp. fell to 24°, or 8° below the freezing point, this, as might be expected, has greatly injured the fruit crop; the max. bar. was 30·22, and the min. 28·50; polar winds prevailed on 11 days, and equatorial on 19; H on 18th and 19th.

BRIDPORT.—The first 19 days fine and genial; on 25th a sharp white frost, ice quarter of an inch thick (on tubs), cutting nearly all the potatoes; this was followed by 8 successive days of R and very cold weather; S falling on 24th; and on 25th heavy R, S and H with a strong gale; the last three days fine and genial; nearly all the apricots are cut off, peaches standing pretty well; cowslips out on 6th.

BODMIN.—Brilliant aurora in the N., at 9.30 p.m., on the 10th.

CIRENCESTER.—Aurora on 15th, from 8.15 to 9 p.m., the streamers were rose-colored and white. On the 21st S fell; and the month altogether must be considered as a cold one for April.

HAUGHTON HALL.—The month opened with a determined R for the greater part of two days; after which it continued dry to the 18th, when R again set in, and, with the addition of four hours' S on 21st, fell every day but one till the 27th, on which day it finished with a fall of ·60, nearly doubling the month's average; fog on the morning of 15th; severe TS, from 3 to 4 p.m., on 22nd, repeated at the same hour of the 24th, both from S.W.

ORLETON.—The rainy season, which set in on 17th Dec. last, ended on the 2nd of this month; thence it was fine, dry, and generally warm till the 20th, when it began to cloud over, and at sunrise on 21st fine S began to fall, increasing in density till 2 p.m., with a violent wind from the N.E., and ceasing about 3 p.m., when all the country was covered with S; the wind then veered to the E., and the temp. rose from 35°, at 3 p.m., to 45°, at 9 p.m., followed by heavy R; on 22nd, two TS with H and R commenced over us, and passed off to the N., one at 12.30, the other at 1.15 p.m.; on 24th a TS commenced about 1.15 p.m., with a loud peal in S.S.W.; an oak shivered to splinters about four miles distant, the storm then passed over to the N.N.E., and a church was struck at Kidderminster, houses at Dudley, and many trees in its course. Very rainy in heavy showers till the 28th, when there was a great fall in the night; the weather was fine thence to the end of the month; temp. of the whole month about the average.

WIGSTON.—Vegetation forward, particularly grass and wheat; apple and pear bloom promises to be abundant; temp. very variable, the range being 45°; snowed continuously for 7 hours on the 21st.

KILLINGHOLME.—Vegetation forward, and a good promise of a fruit crop; the cold and wet have caused the wheat on heavy lands to suffer greatly. Far more R has fallen in the first five months of this year than in any of the six years that I have kept a gauge; a frost doing much damage on 20th; very cold and stormy on 21st.

MANCHESTER.—S and heavy R on 2nd; fine aurora on 10th; S on 19th; T and L on 24th and 25th.

YORK.—Frost on ground on 3rd; mock sun at 6.48 p.m. on 10th; aurora on 12th, 25th and 29th; T at 2.50 p.m. on 24th, with H; T and L on 25th.

NORTH SHIELDS.—Solar halo on 6th; aurora on 15th and 28th; TS on 24th.

SEATHWAITE.—S on top of hills on 18th; H on 19th; T on 23rd.

W A L E S.

HAVERFORDWEST.—First week fine, clear and frosty; from the 11th very cold, bleak and winterly, especially on the 21st, S covering the hills; much cold rain till the 26th; fine to the end; R about the average.

CEFNFAES.—The month cold and ungenial; wind mostly N.E. or S.E.; vegetation forward; heavy storm of rain, T and L, on 25th.

S C O T L A N D.

DUMFRIES.—The first two weeks dry and fine, with slight frosts on several mornings; from 14th to 22nd the weather very cold and withering, with bitter northerly winds; the last week showery and mild; T on 23rd; S on 17th; H on 17th and 23rd. The country towards the close of the month looking beautiful with wild cherry, or gean, and the sloe clothed with masses of bloom. Mean temp. 1·86 below corresponding month last year; mean of cold about the same, but mean of daily heat 3·73 lower; S on the hills on 18th; T and H on 23rd.

SILVERBUT HALL, HAWICK.—Very little sunshine, and often cold easterly winds; frost at night on 2nd, 5th, 8th and 18th; H and S showers on 3rd, 18th, 20th and 23rd. Very violent TS on the afternoon of 23rd, when the L damaged and set fire to the Hawick slaughter houses; the rainfall has been pretty heavy, and the pastures in consequence are looking green and beautiful; aurora on 15th.

AUCHENDRANE.—This April has been a month of rather low temp., slight rainfall, and somewhat small amount of cloud. The winds have been brisk but not stormy, except perhaps on the 20th and 21st, and of the 60 wind observations, 22 were N. or E., 34 S. or W., and 4 calm or variable; there was also a great difference between the mean temp. of the air, and the temp. of condensation; the air has been very dry throughout, and it never once reached saturation; evaporation was consequently very strong, and the rivers have decreased greatly; crops are looking well.

CASTLE TOWARD.—On 20th hills covered with S; prevailing winds from N.E., and E. were bitter cold winds; this month on the *whole* has been favourable for out-door work; fruit trees look well, and grass growing very fast.

DEANSTON.—Cold and blowy; but little R during the first half of the month; very stormy and cold from 16th to 19th; smart frosts at night on 19th and 21st, then stormy and cold, and S on the hills; rainy from 21st to 28th; milder on 24th, with TS and some R; fruit tree blossoms not apparently injured.

LOGIERAIT.—Mild till the 15th; high wind from E. on 14th, and temp. fell considerably and continued low till the 29th.

ABERDEEN.—Temp., rainfall, number of rainy days, and frequency of N. and E. winds, all above the average; estimated pressure of wind rather below it. A wet unseasonable month; several heavy gales; much seed still to sow; S and H on 19th, ground quite white; aurora on 10th, 15th and 16th (red); TS from 5 to 7 p.m. on 12th, house completely wrecked by L near Old Meldrum.

CULLODEN.—Rainfall 37 below the average of 30 years; T on 12th.

PORTREE.—A wet stormy month; heavy gale on 16th and 17th from S.W. to W. with H showers; fall of S on 18th, 19th and 20th; severe frost on night of 19th, which blackened Black Italian and Aspen Poplars and most of garden shrubs; TS on afternoon of 25th.

LOCHBROOM.—With the exception of the 19th and 20th (which were very cold and stormy with sleet and S), the month on the whole maintained the character of its predecessor for very good quality to man and beast; never were the crops so early, nor in such good condition, committed to the ground.

SANDWICK.—The R has been rather above the average; about the 1st and again just after the middle of the month, there were northerly winds with cold weather, but since the 23rd the winds have been southerly and the weather mild; aurora on 3rd and 26th, and one corruscating from zenith on 10th. Wind, 40 miles an hour, from 11 a.m. to 6 p.m. on 3rd., 46 miles an hour, from 8 till 11 p.m. on 8th, and 50 miles an hour, from 6 a.m. on 16th to 5 a.m. on 17th, and continuing till 11 p.m. on 17th, at times 55 miles per hour, but on an average for the whole time 41 miles an hour.

I R E L A N D.

WATERFORD.—Aurora on 11th.

MONKSTOWN.—1·20 of R fell on 21st during the gale from N.N.E.; month cold; vegetation much injured by the gale on 21st and 22nd, especially near the sea.

DOO CASTLE.—Fine month for farming operations, very little R, but temp. low, cold N. and N.E. winds which prevented vegetation; T on 23rd and 24th; gale on the night of 21st.

WARINGSTOWN.—First fortnight cold but generally dry; second wet and cold; labour very much delayed; spring backward.

BALLATER.—We have received, with much regret, intimation of the death of our able correspondent, Mr. J. W. Paterson, of Ballater. The promptitude and punctuality with which he forwarded his reports were only surpassed by their accuracy and completeness.

NATURAL HISTORY CALENDAR.

As the notices of arrival of spring visitors are rather more numerous than usual, we have collected them in the following table:—

		Chislehurst.	Bromley.	Linton Park.	Bincombe, Berks.	Shenley, Herts.	Sandy, Beds.	York Town, Surrey	Hounslow.	Druid Ashburton.	Orleton.	Cefnfaes.	Bridport.	Bromsgrove.	Wigston.	Culford.	Grimshy.	Shiffhal.	Llandudno.	Hawick.	Haverfordwest.	Dumfries.	Culloden.
Cuckoo, first heard	10	11	12	13	13	14	...	14	15	15	15	16	19	22	22	23	25	...	28	28	...		
Swallow, first seen	...	14	...	...	...	...	...	14	...	...	...	13	15	26	23	14	16	...	25	...	14	20	
Nightingale, first heard	10	12	18	...	...	10	11	...	...	...	2	...	...	...	20	...	15	...	...	...	...	24	
Willow Wren	...	...	...	...	...	...	...	...	...	...	...	...	...	26	...	26	...	...	...	...	...	...
Willow Warbler	...	...	...	...	...	...	...	...	...	16	...	...	...	...	...	...	...	...	...	...	...	...
Red Start	...	...	...	...	...	...	...	...	...	16	...	...	...	...	...	...	...	...	...	...	...	...
Black Cap	...	...	...	...	...	...	...	...	...	16	...	...	...	...	...	...	14	...	...	...	...	...
White Throat	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sand Martin	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...	...	...	...
House Martin	...	...	...	...	...	...	...	...	...	...	...	...	...	25	...	25	...	...	...	...	...	...
Tree Lark	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	21	...	...	...	...	...
Spotted Flycatcher	...	...	...	...	...	...	...	...	...	...	...	...	...	28	...	28	...	...	...	...	...	...
White Butterfly, first seen	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...	...	...	...	...
In Flower.																							
In Blossom.																							
Gooseberries																	1	...	...	...	...	...	...
Blackthorn															6	...	1	4	...	...	...	...	...
Apple															18	...	23	18	...	...	...	24	...
Apricot																	18	...	...	...	...	18	...
Cherry											10							...	...	...	...	10	...
Pears																		...	...	...	...	...	...
Plum																		...	...	...	...	...	...
Lime												7							7		...	15	...
Sycamore																			7		...	...	...
Ash																			7		...	...	...
Laburnam																			28		...	...	...
Horse Chesnut																			28		...	...	...
Lilac																			1		...	...	...
May																			29		...	...	...
Elm																					...	28	...
Wood Anemone																	5				...	...	...

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

LXXVII.]

JUNE, 1872.

[PRICE FOURPENCE,
or 5s. per ann. post free]

THE MADRAS CYCLONE OF MAY 2ND, 1872.

ALTHOUGH we have not been favoured by any of our Indian correspondents with notes upon the above storm, we have endeavoured to compile from various sources, a tolerably complete record of its track and principal effects. The following extracts are portions of two letters, which appeared in the *Times* of May 30th, and June 10th. The chart on page 71, together with the remarks which precede it, are compiled from various Madras and other Indian papers, and must be received subject to correction by more ample information :—

“During the months of April and May the weather in Madras is usually almost a dead calm, relieved only by the daily movement of air known when it proceeds towards the sea as the land wind, and when it comes from the sea as the sea breeze. From January to the end of May no drop of rain is expected, and when, about the middle of April, the slight N. E. wind gives way to a still slighter S. W. wind, Madras is in for its hot weather. What this means may be guessed from the fact that Madras stands in Dove's great list as the hottest place in the world. Things bore their usual form till the last day of April, when, almost without warning, heavy rain set in. On the following day, the 1st of May, rain continued, but brought with it a strong wind, which increased in violence throughout the day, until, towards evening, it became a perfect gale, and the strength of the wind did not increase faster than the intensity of the rain. Old Indians foresaw a storm, and began to ask when the ships were going out into the wide, and therefore comparatively safe, expanse of the Bay of Bengal. Madras Roads were then well furnished with shipping, except that, by a strange accident, no steamer was anchored there. Usually there are three or four. There were 18 good ships in the roads, besides 15 smaller vessels known as ‘dhonies,’—vessels built in the country and manned by native crews,—holding about the same relation in size and quality to the other ships as the old collier tubs which plied between Newcastle and London did to the noble East Indiamen which used to lie off Blackwall. Some of the larger ships were owned and manned by natives also, but 12 of them were splendid English ships, two upon their first voyage.

“Many a weatherwise Englishman drove down to the beach on the evening of May-day to see for himself that the ships were gone, and returned grieved at heart. I had seen 14 ships on shore only four years before, and a year later had stood by while another brave vessel had driven through the splendid pier. On both occasions nine out of ten of the English craft had saved themselves by slipping their cables and running out to sea. On neither occasion had things so bad a look as now, yet there every ship rode at anchor, proudly unconscious of the fate that was before it. As I turned sadly away, three-and-thirty sail tossed sleepily over the angry wave, as if they neither knew nor cared why such hoary breakers

galloped in. Yesterday I went again. It was but May 2. Only three of this great fleet were still riding there, and one of them had lost two of its masts, all the rest lay strewn the shore. But I anticipate. The gale increased as night wore on. At about midnight Mr. Pogson, the astronomer, telegraphed from the Observatory to the Marine-office that a fearful storm was near, but this the marine authorities ought to have known long before, for the glass had fallen fully half an inch. Shortly after this the ships were ordered from the shore to get ready, and at three in the morning to cut their cables and stand out to sea. It was too late. The question was not how to get to sea, but how to keep off the shore. The storm was fearful, and the surf rolled clear over everything. Wind and wave were dead set for the shore. At 3 a.m. the native craft were almost all loose, drifting steadily before the wind. One of them struck the pier just about the middle, exactly on the spot where the St. Bernard made a breach three years ago. She went clear through it, for nothing could stand such thumping, with such a hammer as a ship wielded by the mad waves. Neither ship nor pier could stand it. The former went clean through and then collapsed. She now lies a shapeless heap a few yards off. At five o'clock the cyclone was at its height, and half the English ships were adrift.

"The hurricane—for cyclone it was not, seeing that the wind never changed more than a few points—was almost as violent as ever. Few persons could withstand it. The master-attendant was driving down in a heavy carriage drawn by two horses, when the wind upset the carriage, seriously injuring the master-attendant, and leaving him senseless on the road. This is mentioned partly to show the force of the wind, and partly to explain what was seemingly great neglect on the part of the marine authorities. The surf ran at racing speed, in waves that swept over everything. The rain fell in torrents, dashing violently against all in its way. No sound could be heard but the roaring of the wind and the thuds of the leaping surf.

"As well as can be known, it appears that 30 ships in all have been wrecked. Of these 16 are visible; the rest have gone utterly to pieces.

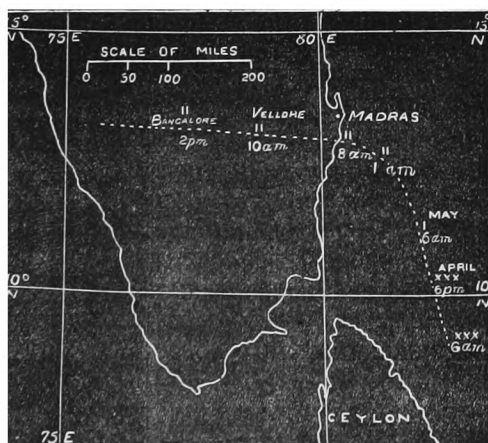
"Madras itself is like a city that has been whipped. Trees lie everywhere about the roads. Two native theatres of immense size are blown down. The ruins of poor native houses stare us in the face on all sides. There has been very little loss of life, although great loss of property."

"Since writing my former letter, the details of the storm have come in from all quarters, with results proving it to have been one of the most extraordinary atmospheric movements on record. This is especially the case with regard to the area it covered. Commencing at daybreak of the 30th of April off the coast of Ceylon, it travelled rapidly northwards, reaching Karikal early on the 1st of May, and Madras at midnight of the same day. Its straight-forward progress, therefore, averaged about 170 miles a-day, or about seven miles an hour. When off Madras, some 70 or 80 miles at sea, it suddenly turned to the left and passed, going almost due west, a little to the south of Madras. It was now on land, and by Thursday, the 2nd of May, at 10 a.m., it had reached Vellore, almost destroying that populous city. At about noon it passed over Arnee, doing great damage. By an hour or two later it was at Bangalore, but with much diminished force. At 6 p.m. of the same day it reached Nundydroog, still passing on over the Mysore plateau with even diminishing force. At Beypore, 400 miles west of Madras, it was felt as a heavy gale on the following day. The storm, therefore, travelled about 700 miles before it melted away. In breadth it was equally remarkable. It has been said that it came up the Bay of Bengal about 100 miles east of the coast line. It was, however, distinctly felt at Madura on the evening of the 30th of April, although on that day the centre of the storm was passing about 220 miles away in the due east. It is not yet possible to say how far the influence of the storm extended on the other side towards Burmah, but the dismayed dhonies, or native craft, now coming in, prove that it was felt in full force far away to the east. There is, in fact, no reason to suppose that there was less width on that side than on this; and we are therefore led to the conclusion that this great current of wind was fully 400 miles wide. These remarks will show that I was

in error in my former letter in stating that the storm was not a cyclone. It did not bear that character here, because it was but one side that passed by us.

"It has been mentioned that a fearful destruction fell upon Vellore. This famous city is situated about 80 miles from Madras, at the foot of the rock upon which stands the well-remembered fort, the scene of the Vellore mutiny. It began to rain there on Wednesday, the 1st of May, but nothing unusual occurred till after midnight, when the rain began to fall with the most astonishing violence. The water descended literally in sheets. Nothing could be seen but this terrific downpour, for it was impossible to see anything more than ten yards away. This extraordinary fall continued till about 3 o'clock in the afternoon, and in those few hours no less than 12 inches of rain fell. This has very seldom been paralleled in any part of the world. Naturally enough, the whole country was very soon placed under water, and this flowed in giant currents towards all the low-lying lands. But the district sloped towards certain tanks or artificial lakes constructed for irrigation purposes, and towards them the water poured from all sides. These tanks are not places of small area as the ordinary English use of the word would seem to imply, but are vast enclosed spaces, many times larger than the Serpentine. The rush of water was aided by the wind, which blew 'great guns.' What with wind and rain the din was deafening, and no cry for help had a chance of being heard. While the tanks were filling, the poorer mud houses in Vellore were falling, for mud walls and thatched roofs are of little use in such a rain. But any shelter was better than none, and the poor wretches to whom the hovels belonged crouched under the ruins in passive despair."

"There was a series of tanks so arranged that the lower should always catch the overflow of the upper, and thus insure that no water should run to waste until all the tanks were full and an ample supply for irrigation obtained. The uppermost of these tanks received the full brunt of the inflow, and was first opposed to danger. Soon, as wind and rain increased, the waves topped the embankment, falling on the other side. Every such wave softened the bund and lowered its top, and it was not long before the bank gave way, and the immense mass of water leapt like a bounding steed upon the lower tank. Nothing could stand such an impact. The bund gave way, and the water now doubled in volume, dashed at the third tank. Four tanks thus breached, and joining all their strength, crashed at the town," and swept a clean path through it, with a loss of probably quite 1000 lives.



Sketch Map of part of Southern India showing approximate track of centre of cyclone between April 30th and May 2nd, 1872.

At Madras the first indication of the advancing (or shall we say forming) storm was on April 28th, when the barometer began to fall.

On the 29th and 30th it was still falling, and there was a heavy and increasing surf, but very little wind. On May 1st the barometer was still falling, and the sea was so high that there was no communication with the shipping; in the afternoon the barometer (reduced to sea level) was 29.54, after midnight it fell more rapidly and at 8.30 a.m. on May 2nd was only 29.288 in., being more than half an inch below its usual reading in May.

The wind at this period of the year is generally light, from the S. but on the 29th it was E., on 30th N.E., and on May 1st N. Its average velocity during the preceding fortnight had been 8 miles an hour, but it reached 15 at 5 a.m. on May 1st, and 20 at noon, moderating to 15 at sunset; it rose again afterwards, was 25 at midnight, and until 3 a.m. remained with that velocity from the N.; at 5 a.m. May 2nd it veered to N.N.E. and was blowing 40 miles an hour, and between 8 and 9 a.m. (simultaneously with the lowest barometric reading) it reached 53 miles per hour from N.E., subsiding by 9.30 a.m. to 40 miles an hour from due E. The total rainfall during the period was 5.75 inches.

We have no desire to be precipitate in condemning without hearing the defence of, those responsible for the immense loss of life and property at Madras, but we can hardly imagine what the defence can be. Even 24 hours' warning should surely in the beginning of May, have told anyone what was to be expected in the Bay of Bengal; but instead of 24 hours there had been at least three days, during which the barometer had been falling, and the surf rising.

ANOTHER METEOROLOGICAL CONGRESS.

(Continued from page 55.)

Thermometer Readings.—In this chapter Dr. Ballot touches on such a variety of questions that if we were to remark upon them all as fully as they deserve, this chapter alone would more than fill all the space we can spare for the remainder of his *Suggestions*. We must, therefore, confine ourselves to a few words on such points as seem of the greatest importance, and on those upon which difference of opinion may arise. Dr. Ballot calls attention to the extraordinary opportunity afforded by the Mont Cenis tunnel for ascertaining temperatures in places separated by thick strata from the surface. We may just remark that this opportunity has been seized and utilized by the Underground Temperature Committee of the British Association, the temperature in the wall of the tunnel is about 85°, but we do not consider that temperatures obtained under conical elevations are comparable with those of deep borings in level tracts of country. The next point claiming notice is the suggestion that all thermometers should be aspirated; we admit the irregularity of reading caused by varying wind force, but are decidedly opposed to universal aspiration for several reasons: (1) Because it would be troublesome, cumbrous, and costly, to provide all the four thermometers (dry, wet, maximum, and minimum,) with

aspirating tubes, and clearly if one is to be aspirated all should be; (2) because it would be extremely difficult, if not impracticable, to aspirate the grass minimum, and yet it would not be comparable with the air minimum unless it was aspirated; (3) because we believe that the draught at different observatories could not be kept uniform, and that for that reason, as well as on account of the varying states of the tubes, the aspirated thermometers would be under conditions quite as diverse as if they were placed on stands properly and uniformly constructed without any aspirating arrangement whatever.

Psychrometer Readings.—Dr. Ballot recommends the psychrometer, or as we should call it, hygrometer, of Prof. von Baumhauer, which he fully describes. But while we quite agree with him as to the inaccuracies of the ordinary dry and wet bulb thermometers, we do not share his anticipations of the superiority of Prof. von Baumhauer's instrument. Has it ever been worked for a whole year uninterruptedly? Has any one compared its results with those of a Regnault, Daniell, or August's psychrometer?

Rain Gauges.—Dr. Ballot does us the honour of recommending the rules of English observers in every respect but one, viz., that he has an inclination for measuring the amount of rain at night instead of in the morning. There are three reasons why we cannot agree to this suggestion: (1) In a hilly country like the British Isles, it is necessary to have gauges on the mountain tops, and in many places far from human habitations, these could not be visited at night, and therefore would not give results comparable with those at home stations if the change were made; (2) evening observations must often be made by artificial light, and are, therefore, less likely to be accurate; (3) by actual investigation we found that more than four-fifths of the British observers measured in the morning, and we believe that we are correct in saying that with quite one-third of them a night observation is out of the question.

Atmometer.—In the matter of evaporation Dr. Ballot is apparently no nearer a practical method of observation than we are in this country; he, however, has evidently come to the same conclusion as ourselves respecting the uselessness of the evaporators hitherto used.

Anemometer.—The only remark calling for special notice is—

“I think it superfluous to inquire, whether the wind has a horizontal direction; so near the surface of the earth it must have.”

What will Mr. Stow say to this?

Observations of Clouds.—The special point of this chapter is the enforcement of the desirability of more frequent observation of the height of clouds, as well as of their direction. Dr. Ballot does not seem to be aware of the cloud mirror of Mr. Goddard, which is extremely useful for the latter purpose. We are glad to find that a scale of 0 to 10 for the amount of cloud would meet Dr. Ballot's support; it is true that he desires higher numbers for denser clouds, but we doubt if he would not yield this point.

Actinometer.—Our author does not specify any one form of instru-

ment either actinometer or pyrheliometer, but he most reasonably urges the importance of continuous pyrheliometric records in "regions blessed by an ever bright sky." The concluding chapters on the *Aspect of the Sky*, *Atmospheric Electricity*, and *Observations at Sea*, like so much of the previous matter, require at our hands nothing but the expression of warm approval.

We have heard nothing definite as to the date of meeting of the proposed congress, but whenever it may held Dr. Ballot's *Suggestions* will render its discussions systematic, and keep them on points of importance. And even should the fulfilment of the proposal be long postponed, his pamphlet will not prove ephemeral, but a storehouse of *Suggestions* for years to come.

REVIEWS.

Meteorological Tables, &c. 1871. [Reprinted from No. XIII. of the Journal of the Royal Institution of Cornwall, 1871.] 8vo., 11 pp. Truro: Netherton.

Meteorology of West Cornwall and Scilly, 1871. [Reprinted from the Thirty-Ninth Annual Report of the Royal Cornwall Polytechnic Society.] 8vo., 20 pp., and one plate. Falmouth: Tregaskis.

THESE papers, jointly, give very full information respecting the meteorology of 1871 in Cornwall, returns being given from Altarnum, Bodmin, Newquay, St. Agnes, Truro, Helston, Falmouth, and the Isles of Scilly. We regret to find that neither Dr. Barham nor Mr. Dymond have succeeded in obtaining observations from Tresco Abbey for last year; in meteorology continuity of observation is all important, and a station which has afforded useful results for several years should not be allowed to drop out without any notice. The solar halo on April 5th, 1871, of which engravings and copious notices appeared in our last volume, is thus referred to:—"On 5th there was a remarkable solar halo, discussed by Dr. Jago in this number of Journal." We have not seen Dr. Jago's discussion, and if it throws any fresh light upon the subject we should be happy to bring it before our readers.

We are glad to find that Falmouth is once more provided with a good rain gauge; it is greatly to be regretted that Mr. Squire's observations were ever interrupted.

In the second pamphlet on our list we are inclined to think that Tables IV. and V., which must have cost Mr. Dymond a large amount of trouble, are uninteresting. They have been formed from the records of the Falmouth barograph, and show the hour of the civil day at which the pressure was greatest, and that at which it was least. Now, a moment's reflection will show that (with the irregular changes of the barometer which occur in these islands, and which as a rule continue in one direction for two or three consecutive days,) the maximum and minimum will of necessity occur chiefly at the time of separation between any two days, whatever that time may be, whether noon or midnight, or any other hour. The hour of midnight having been

selected, the results detailed in the following paragraph are just what might have been anticipated, but we fail to see their utility :—

“Tables 4 and 5, showing the hours of maximum and minimum pressure at Falmouth exhibit results very similar to those of last year. The maximum pressure (Table 4) occurred at 1 a.m. on 127 days, and at midnight on 81 days ; in 1870 the figures were 114 and 94. The middle of the night is again shown to be the period of highest pressure, and the secondary period of high pressure about 11 a.m. is also, as it was last year, plainly visible in the table. On only 10 days was the maximum pressure reached between the hours of 3 and 8 in the morning or afternoon. The minimum pressure (Table 5) was recorded 80 times at 1 a.m., and 102 times at midnight ; in 1870 these figures were 67 and 100. The secondary low pressure period in the afternoon will be observed, with a similar tendency to that noticed last year to be earlier in the afternoon in winter than in summer.”

Having expressed our opinion of these tables, we have now much pleasure in turning to those which follow them, and saying that they are equal to any that we receive from any part of the country. The large folding plate of barometric and wind curves is also very clearly and well done.

Results of Meteorological Observations made at the Royal Observatory, Cape of Good Hope. Chiefly under the superintendence of Sir THOMAS MACLEAR, K.T., F.R.S., &c. Discussed and printed under the superintendence of EDWARD JAMES STONE, M.A., F.R.S., &c., H.M. Astronomer at the Cape. 8vo., cloth, 33 pp., and folding plate. Cape Town : Solomon and Sons.

IN the “First number of Meteorological Papers published by authority of the Board of Trade,” Admiral FitzRoy reprinted a paper by Sir Thomas Maclear, entitled “Results from Meteorological Observations made at the Royal Observatory, Cape of Good Hope, between January, 1842, and January, 1856.” It appears somewhat strange that in the work before us Mr. Stone makes no reference to the above-quoted work, of which, in *some respects*, his may be considered an extended edition. The two works are, however, quite different in style of composition and treatment, Mr. Stone's being (if we may so describe it) the more mathematically toned of the two, and drawn up in a form much resembling that adopted by the late Manuel Johnson, for the Radcliffe Observations. The introduction enters very fully into the question of the probable errors of the thermometers employed during the last thirty years, and this is not to be wondered at when we find such statements as this :—

“The following are the deduced corrections for the principal thermometers :—

1870. *December.*

Dollond	Adie.	Negretti. (No. 752.)	Casella. (Nos. 9685 and 9679.)	Casella. (No. 10146.)	Jones.	Robinson.
—0°·62	—0°·87	—0°·76	—0°·36	+0°·17	—0°·54	—0°·87

The Regnault standard had nearly the same index error as Adie ; whilst in 1852 the readings of these two* thermometers differed by nearly 0°·4.

* In the pamphlet the word “the” is printed where we have inserted the word “two.”

It is unnecessary to inquire who was responsible for sending out thermometers which were liable to such a great change in their zero points; but we do hope that our colonial observatories will no longer be provided with "thermometers with large spherical bulbs and tubes of considerable interior bore." Mr. Stone has, however, adopted the best course in saying that—

"It is my intention to have the zeros of our standard thermometers independently determined annually, and the index errors of the thermometers in use then determined by a comparison with these standards."

It is rather singular that neither Sir Thomas Maclear nor Mr. Stone have stated the position of the rain gauge either with respect to surrounding objects, or to height above ground, or sea. This omission seriously lessens the value of the table of monthly rainfall, which is complete for thirty consecutive years. The mean annual amount is 24·10 in., and the range from 18·67 in. in 1865 to 36·72 in. in 1859, the former being 22½ per cent. below, and the latter 52½ per cent. above the mean of the whole period. The mean annual temperature is about 61°·3, and the mean annual pressure 30·07. The following is an abstract of the results:—

Month.	Barometer corrected and reduced to 32° at sea level.	Mean Temp. in Shade.	Elastic Force of Vapour.	Humidity.	Rain.	Cloud.	Wind. Mean hourly velocity.
	in.	°	in.		in.	(0—10)	miles.
January	29·966	69·2	·457	67	·72	2·8	14
February	29·963	68·5	·466	68	·67	3·2	14
March	30·002	66·0	·436	69	·78	3·3	12
April	30·053	61·7	·410	74	1·74	4·0	9
May	30·104	57·7	·373	80	3·64	5·2	8
June	30·158	55·1	·350	81	4·65	5·2	8
July	30·199	54·2	·333	80	3·47	4·6	8
August	30·172	55·7	·345	80	3·06	4·7	9
September ...	30·134	57·1	·355	77	2·13	4·9	10
October	30·079	60·2	·378	73	1·58	4·9	12
November ...	30·029	63·3	·401	69	1·06	4·0	13
December ...	29·987	67·1	·434	67	·60	3·1	14
Means&Totals	30·070	61·3	·395	74	24·10	4·2	11

Barnstaple Literary and Scientific Institution Twenty Seventh Annual Report. 12mo., 14 pp. Barnstaple: Knill.

CALLS for no special notice except that in the meteorological table the mean amount of cloud is very small, 3·6 is the annual mean, and in the most cloudy month it is only 5·8. This may arise from under-estimation on the part of the observer, but we are rather inclined to consider it a probable characteristic of our western shores, inconsistent though it at first sight appears with their unquestionably heavy rainfall.

Currents and Surface Temperature of the N. Atlantic Ocean from the Equator to Latitude 40° N. for each month of the year, with a General Current Chart. [Published by the authority of the Meteorological Committee.] 4to., 48 pp., 13 plates. Stanford.

THERE used to be a tolerably clear boundary between the duties of the Hydrographical Office of the Admiralty and those of the Meteorological Office, but it now seems so often crossed in both directions, that a fusion of the two offices would never surprise us, and might very possibly be beneficial. We have heard it stoutly maintained (and it is reported that even the hydrographer concurs in the opinion) that thermometers for taking the temperature of the deep sea are *not meteorological instruments*, but are hydrographical ones. And now we have from the Meteorological Committee a series of charts of oceanic currents, which surely are not so strictly meteorological as hydrographical. The fact is it is impossible to draw a line between the two branches of investigation which shall not be prejudicial to both, and it is too great a demand on any one's patience to be told that the temperature of the surface of the sea belongs to one department and that of the water below the surface to another.

The work before us has been a long time in preparation; it was started by Admiral FitzRoy a few years after the office was established, and it was partially published in 1859. Two years afterwards the great work, "*Onderzoekingen met den Zeethermometer*," was published by Dr. Buijs Ballot; many of the results in it were available for incorporation with the English work, and have therefore been converted into English measures and utilized in the present publication. The general consistency of the values plotted on the maps (except where the currents are very feeble) seems to indicate that Admiral FitzRoy's opinion, that faulty observations would neutralize each other, was correct, and that from amid the errors so frequent in the logs Mr. Strachan has contrived to elicit a large store of valuable facts. The merely nominal price at which the happy circumstances of the Meteorological Committee enable them to sell the publication, places it at once within the reach of all those of our readers who wish to trace the phenomena of our climate to their frequent birthplace over the blue waters of the Mexican Gulf or amid the tangled forests of the Sargasso Sea.

Report of the Rugby School Natural History Society for the year 1871.
8vo., 68 pp., 5 plates. Rugby: W. Billington.

THIS report is quite equal to, if it does not surpass, the one which we had the pleasure of noticing last year. It contains several capital papers by present members of the school, which reflect great credit on all concerned. We quote a meteorological one verbatim, omitting only some paragraphs explanatory of the mode of plotting the observations adopted at Rugby:—

E. Burchardt, (member,) read the following Paper on "*The Cold Week in May.*"

"It is a curious fact that the week extending from the 8th to the 15th of May is sure to be colder than the one before or after it. Many scientific men have observed this, and all have fixed the date of this fall of temperature at about the same part of the month; namely, somewhere between the 8th and the 15th; the greatest cold generally occurring on the 11th. But though it was left for science to fix by observations the exact date of this, we have abundant proof in the proverbs of several countries that it was long ago observed and very generally established as a fact; and in these cases the evidence of proverbs is often very valuable, as they are often founded on long and general observation. The Scotch have a saying,

'Ne'er cast a clout
Till May be out.'

The French say, 'In the middle of May comes the tail of winter.' The Germans have a proverb to exactly the same effect; but they also have one which runs, 'He that shears his sheep before Servatius' day loves his wool more than his sheep.' Now Servatius' day falls on the 13th of May, and it is interesting to find that he and the other three saints, whose festival days run from the 11th to the 14th, are called in some parts of Germany and Holland 'Eisheiligen,' or 'Eismänner,' that is, frost saints or frostmen, because they are believed to bring cold with them. There are also in Italy several proverbs relating to this cold week in May, but I have quoted enough to show that it has been observed so long as to pass into a common saying, not only in northern latitudes, but even as far south as Venice and Milan.

"When Captain McClintock was in the Arctic sea, searching for Sir John Franklin, he noticed that this fall of temperature took place in the extreme north also. In his 'Journal of the Search for Sir John Franklin,' this is an entry: 'May 10th, 1858. On the morning of the 8th we left Holsteinborg with a pleasant land wind and bright weather. When 15 miles off shore we were stopped by ice formed in the night, the thermometer having fallen to 12°.' But on the 14th, 'Summer has suddenly burst upon us, thermometer up to 40°.'

"On May 16th, the year after, he says, 'We have not had a single clear day since the beginning of the month. Temperature at zero.'

"The average temperature of May exceeds that of April by about 7°. June exceeds May by 6½° in England. Between no other two consecutive months does the average temperature differ so greatly, except between October and November, when it is 7°, and September and October, when it is 6°. Since then the average temperature of May is so much above that of April, the thermometer ought to rise during May. And so it does, excepting the week from the 8th to the 15th, in which it invariably falls.

* * * * *

"The cause of the sudden cold in May is some body that comes between us and the sun, and so shuts off its light and heat from us. As it cannot be seen with a telescope, it must be a cloud of small bodies, not a single one. It must be moving, or else it would soon be drawn into the sun by attraction. Its orbit cannot be in the same plane as ours, or else it would always be between us and the sun. It is, therefore, inclined to our orbit, crossing it at the part we are on the 11th of May. But, to cause a cold week every May, it would have to reach that part of its orbit which crosses ours on at the exact time when we reach that part of our orbit which it crosses.

"And as this would be a most unusual coincidence, it must be *always* crossing that part of our orbit. The only solution is, that it must be a ring of small bodies, moving in an orbit like the earth and planets. A ring turning round the sun, as the tire of a wheel round its axle.

"But, if this is the case, why do we not have one week in November colder than the others? for the earth would reach in November that part of its orbit opposite to that which it occupies in May, and the ring would again cross between us and the sun. The reason is that this time it crosses our orbit outside, being looped into it, so as to pass inside it between us and the sun one time, and outside, so as to have us between the sun and it at the other time.

"And though we have no cold week in November, as we have in May, we have showers of meteors on the 14th. And these meteors are now known to be the bodies which obscure the sun in May, and which cross our orbit again in November. In 1866 these November meteors were seen very beautifully, in far greater number than in other years. The reason for this is that the ring of meteors is thicker in some parts than others, and in that year we broke through the thickest part of it. The period in which these meteors perform one revolution is $33\frac{1}{4}$ years.

"This is the probable cause of the cold week in May. But there is one thing still wanting. These meteors have never been *seen* crossing the sun. Although everything tends to prove that they *do* cross the sun in May, they have never yet been seen. This is easily accounted for when we remember that, supposing them to be the same as the November meteors, they are very small. And a cloud of small bodies crossing the sun would be detected only by its power of shutting off the light and heat from us, and throwing us into its shadow. Still it would be more satisfactory if it had been seen. Therefore every May astronomers are on the look out for it, but, so far, unsuccessfully.

"Not long ago, Herschel saw, in India, some objects, visible only with a telescope, crossing the sun, and darkening it. They moved steadily across in great numbers, all going one way, except one, which suddenly turned off at right angles to the rest. As these bodies seemed to be exactly what he was looking for, except that one which turned away from the path of the rest, he naturally thought that he had seen the bodies which cause the cold weather in May. But, with many others who were exulting over this great discovery, he was to be disappointed; for shortly afterwards he found that what he had seen was a large swarm of locusts flying at a great height above the earth, which afterwards settled in the north of India. And so this cause of the cold week, although known to exist, still remains to be actually seen in the act of shutting out the light of the sun from us."

BOOKS RECEIVED.

Silver's Handbook to South Africa. With Preface by H. W. BATES. Small 8vo., 2s. *Quarterly Return to March 31st, 1872, of Births, Deaths, Marriages, and Meteorology in Scotland.*

Barnstaple Literary and Scientific Institution. Twenty-seventh Annual Report.

A Key to the Seasons and Weather; the result of Forty-two Years' Observations.

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Results of Meteorological Observations made at the Royal Observatory, Cape of Good Hope. By Sir T. MACLEAR. Discussed by E. J. STONE, M.A., F.R.S., H.M. Astronomer at the Cape. Large 8vo., cloth.

Results of the Magnetical and Meteorological Observations made at the Royal Observatory, Greenwich, 1870. 4to.

THE THUNDERSTORM OF JUNE 2ND.

To the Editor of the Meteorological Magazine.

SIR, — A very violent thunderstorm passed over this neighbourhood last evening. Distant thunder was first heard in S.W. at 5.45 p.m. A tremendous fall of rain commenced at 6.20, and continued till 6.50 p.m., when the amount in the gauge was 0.78 in. No thunder was heard from 6.15 to 6.40, when there was a terrific flash of lightning right overhead, and from this time till 7.30 the lightning was very frequent and vivid, and the thunder incessant. Very little rain fell after 7 p.m.; distant thunder continued in N.E. till 8.15 p.m.

Yours truly,

THOS. PAULIN.

Winchmore Hill, 3rd June, 1872.

THE THUNDERSTORM OF MAY 31st.

To the Editor of the Meteorological Magazine.

SIR,—Richmond was visited on Friday last, May 31st, by an unusually heavy storm of rain and hail. The storm began about 5.20 p.m., and lasted twenty minutes. The amount of rain collected by my gauge during that time measured 0.60. This storm was followed at 6.50 p.m., by another sharp shower of only a few minutes' duration, raising the fall of twenty-four hours to 0.63.

The direction of the storm-cloud was W.N.W. ; the atmosphere was calm, and only one flash of lightning was observed.

After the storm a gravel path here was thickly strewn with the leaves of a Wisteria, trained up the north side of the house, which had been cut off by the hail.—Yours truly,

EDWD. MAWLEY.

Halford House, Richmond, S.W., June 5th, 1872.

WATERSPOUT AT STEYNING, SUSSEX.

To the Editor of the Meteorological Magazine.

SIR,—Though much weakened by illness, I must send you an account of a water-spout that burst on the hill about a mile S.W. of Steyning, at 1 p.m. on Monday, the 3rd inst., with lightning and thunder.

It was observed by many persons in the neighbourhood, and is described as a column tapering to the middle from top and bottom. But a man leaving the hill with a waggon-load of flints was caught in it, and so frightened was he by the body of water that fell, that he left his horses to themselves, and took refuge under his waggon. Here the rainfall was not very heavy—only 0.31 inch being registered for the 24 hours ending at 9 a.m. on the 4th inst. The first lightning was, however, very close, being instantly followed by an alarming crash of thunder. The water-spout appears to have broken up into heavy rain on leaving the high ground.

I did not see it myself, but was witness of the previous gathering of the clouds, which illustrates the truth of Mr. Parnell's theory. Many detached cumuli had continued drawing up from the N.W., only discharging rain or hail when in combination with cloud of a higher stratum. Three such towering masses were seen to hang for some time over the hills, and to gather blackness from a lower layer of scud which boiled up from the air beneath, and was agitated in a S.W. current across the line of the chief current. Almost at the same moment there appeared a third layer of (cirro-stratus) cloud in a still higher region, also moving in a S.W. current. The rain and hail at once commenced falling from this, and soon amalgamated the moving masses into a huge rain-cloud, driven by a W.S.W. current, and the storm then burst with increased violence in the S.W., whence it drew gradually to the S.E., a carter being struck down and temporarily stunned by lightning at Hangleton, near Brighton.

I remain, yours faithfully,

HUGH INGRAM.

Steyning, Sussex, 11th June, 1872.

MAY, 1872.

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.			
											inches.	in.	Deg.	Date.
I.	Camden Town	3.05	+	.65	.74	13	18	75.9	27	33.2	20	0	2
II.	Maidstone (Linton Park).....	4.35	+	2.11	1.11	13	18	79.0	29	29.0	12	4	...
III.	Selborne (The Wakes).....	3.40	+	.92	.53	13	20	70.0	27*	28.0	20	3	5
IV.	Hitchin	3.01	+	1.08	.62	17	18	69.0	27	31.0	18||	3	...
V.	Banbury	1.11	—	1.11	.26	13	17	69.5	29	29.0	19	2	...
VI.	Bury St. Edmunds (Culford).....	2.53	+	.37	.53	18	14	73.0	27	30.0	11**	5	9
VII.	Bridport	1.88	—	.15	.70	13	17	69.0	27	29.0	19	5	...
VIII.	Barnstaple	1.93	—	.51	.36	6	11	68.5	2	35.0	12	0	...
IX.	Bodmin	3.14	+	.68	.53	23	19	66.0	27	36.0	19	0	2
X.	Cirencester	2.09	—	.19	.48	7	21	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall)	2.06	—	.20	.43	15	17	69.0	27	30.0	19††	2	...
XII.	Tenbury (Orleton)	1.96	—	.92	.33	15	18	72.7	27	29.6	19	2	7
XIII.	Leicester (Wigston)	2.13	+	.01	.40	13	16	72.0	1	29.0	18	2	...
XIV.	Boston	1.74	—	.20	.37	9	16	72.1	29	33.0	19	0	5
XV.	Grimsby (Killingholme)	1.36	—	...	.29	11	16	70.0	27	31.0	11	1	...
XVI.	Derby	1.63	—	.53	.30	7	16	71.0	27	32.0	19††	2	...
XVII.	Manchester	2.15	—	.51	.46	8	19	69.5	29	31.0	20	1	3
XVIII.	York	1.02	—	.93	.32	11	9	67.5	1	32.0	19	1	...
XIX.	Skipton (Arncliffe)	3.94	+	.59	.90	4	17	...	...	...	...	...	...
XX.	North Shields	1.96	—	.68	.30	7	21	67.0	1	34.2	20	0	1
XXI.	Borrowdale (Seathwaite).....	9.54	...	.00	2.39	3	19	...	...	...	...	...	...
XXII.	Cardiff (Ely).....	2.18	—	.42	.72	8	12	...	...	...	...	...	...
XXIII.	Haverfordwest	2.30	—	.42	.90	20	13	67.0	27	33.0	22	0	5
XXIV.	Rhayader (Cefnfaes).....	...	...	...	...	...	...	...	...	...	...	...	...
XXV.	Llandudno	2.02	—	.36	.33	11	17	68.2	26	35.3	20	0	...
XXVI.	Dumfries	3.29	+	.90	.49	6	20	65.0	26	31.0	18||	2	...
XXVII.	Hawick (Silverbut Hall).....	3.66	—	...	.45	7	25	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House).....	3.10	—	.01	.57	3	20	61.0	26+	29.0	19	3	6
XXIX.	Castle Toward	3.79	+	.40	.60	15	22	58.0	28	32.0	...	...	...
XXX.	Leven (Nookton)	2.92	+	.92	.56	14	22	66.0	25†	32.0	18	1	12
XXXI.	Stirling (Deanston)	2.99	+	.34	.68	14	23	66.0	25	28.0	19	6	11
XXXII.	Logierait	2.40	—	...	.57	14	12	70.0	26	30.0	18	...	...
XXXIII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Aberdeen	3.76	—	...	.78	14	24	67.2	26	34.1	20	0	13
XXXV.	Inverness (Culloden)	3.63	—	...	.87	17	20	58.5	29	35.9	19	0	3
XXXVI.	Portree	5.66	+	.01	.96	28	28	...	...	...	...	...	...
XXXVII.	Loch Broom	3.91	—	...	.45	11	25	...	...	...	...	...	...
XXXVIII.	Helmsdale	1.43	—	...	.17	3, 19	20	...	...	...	...	...	...
XXXIX.	Sandwick	1.69	—	.57	.26	19	19	61.0	1	34.3	11	0	14
XL.	Cork	1.50	—	...	.59	19	14	...	...	...	...	...	...
XLI.	Waterford	1.41	—	.84	.21	21	20	66.0	27§	36.0	12	0	...
XLII.	Killaloe	2.45	—	.73	.40	6	19	72.0	28	29.0	19	2	4
XLIII.	Portarlington	1.92	—	1.28	.26	8	27	65.5	26	31.5	18	1	...
XLIV.	Monkstown	1.67	—	.24	.29	15	16	71.0	26	28.0	20	2	...
XLV.	Galway	2.30	—	...	.30	2	21	64.0	25†	33.0	19	0	...
XLVI.	Bunninadden (Doo Castle) ...	2.43	—	...	.37	6	20	61.0	14¶	28.0	12	2	...
XLVII.	Bawnboy (Owendoon) .....	...	—	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	2.61	—	...	.45	7	22	70.0	16	31.0	19	1	8
XLIX.	Strabane (Leckpatrick)	2.52	—	...	.43	3	27	...	...	...	...	...	...

*And 28, 29. †And 27. ‡And 26. §And 28. ¶And 16. ¶And 19. **And 18. ††And 20.
 + 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.

LINTON PARK.—Excepting the first two and last seven days, the whole of the month has been wet, cold, and ungenial, with frosts and ice nearly a quarter of an inch thick on the 12th, and ice again (though thinner) on the 20th. H, S, and sleet frequent. T, mostly distant, on 8th, 9th, 24th, and 31st. Winds principally from the S.W. and W., but on the two wettest days, the 13th and 18th, when 1.11 in. and 0.98 in. respectively fell, the wind was due N., verifying the popular idea that when R does accompany a wind from that quarter, it is a heavy one. Bar. mostly unsteady. The cold, ungenial weather has been very destructive to the fruit crop, and vegetation, which was early at the beginning of the month, is late at the end of it, grass alone being in a forward state.

SELBORNE.—Prevailing winds first and last week S.W., middle N. and N.E. Windy with hail in afternoon on 4th and 5th; violent hailstorm with T at 11 a.m. TS with H and R in afternoon of 7th. Repeated hailstorms on 8th, with TS at 4 p.m. and frequent hail showers on the 9th. Remarkable change of temperature between the 17th, when the min. was 47°·5, and the 20th, when it was 28°·0. Potatoes cut by the frost on the 20th.

BANBURY.—High wind on the 3rd, H on the 5th, 7th, and 23rd. Ball snow on 11th, T on 8th and 15th.

CULFORD.—Several slight frosts during the month, which has been somewhat cold for May, the mean temp. being below that of 1871. Polar winds prevailed during 13 days. Min of month, 30°, on 11th and 18th, and 34° on night of 31st, causing frost on the grass on the 1st of June. High wind on the 4th; T on 7th, 8th, and 11th; H on 7th and 11th.

BRIDPORT.—The first three weeks of the month were rough and stormy; on the 11th storms of sleet and in the neighbourhood heavy snow fall. On the 20th severe TS, in the neighbourhood of Litton, about six miles from here; several sheep were killed by the L, trees torn down, Blagdon monument struck and five men seriously injured. Sharp frost on the 19th, cutting the potatoes severely.

BODMIN.—Fine streamers of aurora radiating from the N. on the 9th. The month remarkable for its cold, ungenial weather, temp. 1°·5 below the average.

CIRENCESTER.—On May 11th a considerable fall of S in the morning and again in the afternoon, when at 3.30 the darkness was so great that gas was required to enable one to read.

HAUGHTON HALL.—Up to the 12th R daily, from which time frequently, but farmers able to get in their swedes and mangold wurzel seed. Sharp frosts on 19th and 20th, damaging greatly early potatoes and apple blossoms, even the oak leaves cut on low grounds. The high temp. with which the month opened sank to 52° on the 8th, on which day vast cumuli clouds with T and H, slight S on 11th, T and H again on 22nd and 31st. Oaks in full leaf on 29th, but the ash late, many not bursting; pastures most luxuriant; orange-tipped butterfly on 1st; house martin seen on 6th, turtle dove appeared on 9th, fly-catcher first seen on 25th. Lilacs in blossom on 2nd, lily of the valley in flower on 4th, hawthorn in blossom on 15th.

ORLETON.—A cloudy, cold ungenial month, with the exception of a few fine warm days at the beginning and end of the month. Mean temp. 2° below the average. Severe frost on the morning of 19th, which cut down the young ash, potatoes, and other tender plants. S on the 11th, H frequent, T on 7th, 8th, 15th, 21st, 22nd, and 23rd, but always distant.

KILLINGHOLME.—A cold month, grass very abundant, wheat not likely to be a heavy crop, oats and barley more promising; TS on 7th, with H, and again on the 8th, when a man and horse were killed by the L near Grimsby.

DERBY.—A cold ungenial month, the mean temp. being 2° below the average of seven years, two or three frosts in the country doing damage to the fruit trees and potatoes.

YORK.—High wind on 4th, mock sun on 5th and 6th, solar halo on 6th, Aurora on 7th, T on 8th, H on 10th.

ARNcliffe.—Wind chiefly W. and N.W., but very cold, very high on 13th; ther. on grass on night of 21st, 24°.

NORTH SHIELDS.—H on 11th, and with S on 17th and 19th, TS on 22nd, and T on 23rd.

SEATHWAITE.—S on tops of hills on 4th, 7th, 8th, 11th, and 22nd; H showers on 5th and 30th. The total rainfall exactly the average.

W A L E S.

HAVERFORDWEST.—A cold ungenial month, March-like in character, at times very cold and stormy, morning and evening very cold; there could scarcely be one day called a summer day. Vegetation backward. The 20th of May (Whit Monday) will long be remembered for its wintry character; the day opened cloudy and dark, with wind in fitful gusts from S.E., accompanied by clouds of dust; cold rain commenced at noon, wind increasing to a gale, afternoon very wet and stormy, it cleared a little about 4 p.m., at 6 p.m. the sky became very dark and presently a fearful storm of T, L and H, the L very vivid and forked; hail mingled with sleet, lay 3 inches deep on the ground; hail as large as marbles and the gusts of wind violent. About 9 miles from here, at a place called Brawdy, the L struck a thorn bush, splitting it and scorching the branches, passed through the hedge and crossing the road tore through the opposite hedge, dislodging the earth and stones, ran along the field, burning the grass, and finally killed a fine sheep. Three miles from thence, in a direction N.E., at a place called Carvoriog, the L struck a man sitting on his cart and killed him instantly; the direction of the storm was from N.W. to S.E.

S C O T L A N D.

DUMFRIES.—The first three weeks were rainy, cold, and ungenial for the season of the year, the close of the month fine; the temp. at night much the same as last year, but during the day 6°·5 lower; the season two or three weeks later than last year, the country is however fresh and very beautiful. T on 9th and 15th, H on 19th, 22nd, and 23rd; S on 11th and 19th. Hawthorn in bloom on 18th.

SILVERBUTT HALL, HAWICK.—A wet and very cold month; N.E. winds most prevalent; hills white with snow on 11th, S and H showers on 8th, 9th, 11th, 17th, 19th, 20th, and 29th. T on 8th, 9th, and 30th. Landrail first heard on 24th. The gooseberry caterpillar has not yet appeared on the bushes.

AUCHENDRANE, Ayr.—This month the mean bar. pressure, mean temp., elastic force of vapour, force of wind and evaporation, were all *below* our May means, the difference also between the mean temp. of air and that of dew point was less, and the air more humid; on the other hand, the bar. range, rainfall, and amount of cloud were all *below* [above?—Ed.] the May mean. Thus May has been here a cold rainy month, and although the night temp. of the two weeks, 12th to 25th, was very low, there were no severe frosts to injure the fruit trees, and notwithstanding the great rainfall moderate winds, cloudy sky, and weak evaporation, the rivers have fallen rather low, owing, no doubt, to the enormous consumption of water by the vegetable kingdom at this season of the year. Crops continued to look well. No TS occurred during the month.

CASTLE TOWARD.—Nearly 2·00 in. more rain fell during May than in April, and 40 in. more than average, but little sunshine, with cold piercing wind; the month was generally dull, cold, and damp, prevailing winds N.W. and W.; max. temp. 58° on the 28th, min. temp. 32°·0. Crops look well, as do the fruit trees. On the whole it has been a good favourable month for out-door work.

NOOKTON.—T at 3 p.m. on 8th, and again on 9th, at the same time. H on 8th and 11th, S on 9th and 10th.

DEANSTON.—General character of this May, cold, rainy (with H showers), and backward, about 4° colder than in May, 1870. Severe frosts at night; potatoes blackened on 19th and 21st. TS on 8th and 22nd.

LOGIERAIT.—From the 15th, cold and ungenial, with E. winds prevailing; temp. low, and vegetation backward. Ther. at or below 34° on nine nights.

ABERDEEN.—A month of wet, dull, raw, unseasonable weather, winds generally light, but those from S.W., N.W. and N. more frequent than usual. On the 14th, at 5 a.m., a severe T.S. and H storm between 1 and 2 p.m.; fields quite white with hailstones from a quarter to half-an-inch in diameter; ground white with snow at 8 a.m., on 10th, heavy hail on 31st.

PORTREE.—The coldest May on record; ground covered with S from 17th to 23rd; ice on morning of 19th three-eighths of an inch thick; a tremendous shower of very large H from 1.40 p.m. (on 23rd) till 2.10 p.m., being preceded by an awful noise something like the blowing off of steam from a strong boiler. A heavy gale all day on 17th from the N., and another on 29th from S., continuing from 12.0 p.m. to 4.0 a.m. The frost has nipped all vegetation, and the weather continues cold.

LOCHBROOM.—This has been a remarkably cold month, especially as compared with the warmth of the three previous months; there were only six dry days, and most of the rainy ones had H and S, and piercing winds from N. and E.

SANDWICK.—Northerly winds from 4th till 23rd, but since then the weather has been mild and pleasant. A little H at noon, and a red sun pillar at sunset on 10th. Aurora at 1 a.m. on 11th.

I R E L A N D.

WATERFORD.—Owing to the prevalence of N. and N.E.*winds during the month the weather has been very cold; it was N. or N.E. on twenty-one days, and N.W. on seven days.

MONKSTOWN.—A cold drizzly month, N.W., N. or N.E. winds prevailing for three weeks, and the temp. low; heavy H on 9th.

GALWAY.—H R S and T from 1.15 p.m. to 2.20 p.m. on 19th. H. on 21st.

DOO CASTLE.—This month has been remarkably cold for the season, the wind blowing from N. or N.E., as a consequence there has been little vegetation of any kind, grass almost disappearing off the pasture land; potatoes injured by frost of 12th.

WARINGSTOWN.—The wind varied from E. to W. of N. for twenty-six days this month, with cold showers on most days. Altogether this has been the coldest month of May I ever remember.

LECKPATRICK.—Rainfall 0.10 above the average of the last ten years.

ON THE SPRING OF 1872.

To the Editor of the Meteorological Magazine.

SIR,—With the exception of 1869, when the rainfall of the first five months was 14.21 in., that of the present season, 13.85 in., is the wettest I have on record for 18 years for the like period, that of 1860 was, however, 13.84 in. The past May was the wettest I have registered for that month, and also the coldest, for apart from the four days' frost reported in the table, there were several occasions when slight frosts were visible in certain places, even as late as the 1st of June, while the ice on the morning of May 12th was so thick as to allow a basin that I had put outside half full of water to be turned upside down without the water escaping, the thermometer denoting 29°, not near so low as is reported from many other places, but as it continued at that point for so many hours, the ice was formed as stated. Taken as a whole, May will be long remembered as a disastrous month to the fruit grower.

J. ROBSON.

Linton Park, Maidstone, June 2nd, 1872.

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

LXXVIII.]

JULY, 1872.

[PRICE FOURPENCE,
or 5s. per ann. post free]

THUNDERSTORMS.

THUNDERSTORMS of such unusual frequency, extent and severity, have occurred since the 16th of June, that we have undertaken to compile a record of their phenomena and results. By doubling the size, and trebling the contents of the present number, we are able to report in a condensed form most of the events of the storms of June 17th, 18th, and 19th. In our next we hope to complete the record, and give such maps, &c., as may be required to render evident the localities most severely visited, and perhaps the general features of the storms as indicated by our reports. For this purpose we shall be glad to receive *brief* notes, such as "No storm here between 16th and 21st;" or, "Violent storm passed from S.W. to N.W., between 5.30 and 7 p.m. on 16th, total rain, 2.12 in. in 1½ hours."

GREENWICH AND KEW.

WE are afraid that there are signs of a coming struggle between the authorities of the observatories at Greenwich and Kew. This would so seriously impede the progress of science, and in every respect be so prejudicial, that we deem it our duty to devote a few pages to the consideration of the object, aims, and present condition of the two observatories, so far as relates to meteorology.

The Royal Observatory at Greenwich is an institution of which every Englishman should be proud; the efficiency of the Astronomical department is, we believe, unassailable; but it is only with the Meteorological department that we are concerned. We cannot refrain from expressing our regret that the Astronomer-Royal should have penned the following remarks in the Report presented to the Board of Visitors, on June 1st:—"Indeed the Observatory has long been a Physical Observatory by virtue of its Magnetical and Meteorological department, the systematic observations in which are,

as I believe, the best in the world." We are not aware that the Astronomer-Royal ever devoted much of his own thought to Meteorology, and we therefore feel the less hesitation in saying that if they are "the best in the world" they are far from perfect. We consider that the Osler's anemometer, so far as regards the records of high pressures, has been useless for a long time. We consider that the space devoted to Meteorology is too much shut in by trees, shrubs, and buildings, and thereby, not only are the rain gauges too much sheltered, but also by the "glare" from the white buildings the temperature is unduly raised. We consider a barometer with an error of about 0.006 in. should not be the best standard of our National Observatory, and we agree with the Astronomer-Royal that "the electrical apparatus is not satisfactory."

But, in spite of all these points, we should look upon the suspension or cessation of the Greenwich Meteorological record as a national disgrace and a scientific disaster. The Greenwich records are not perfect (and it would, we think, be wise to set one computer to go deliberately through them with the sole object of detecting errors), but if the value of a meteorological record may be considered as the product of (accuracy \times duration), we maintain that it certainly has no equal in this country, and few, if any, in the world. Extending as it does to the early years of the present century, it would be suicidal madness to allow it to be stopped. We have not heard that the proposal has been made, we hope that it never will be, and we believe that in directing attention to its preposterous folly we are taking the best steps towards preventing the interruption of that which could never be replaced. That there is nothing unreasonable in our calling attention to the question is shown by the conclusion of the paragraph, part of which we have already quoted. In its entirety it is as follows :—

"Indeed, the observatory has long been a physical observatory, by virtue of its magnetical and meteorological department; the systematic observations in which are, as I believe, the best in the world. They remove all necessity of subvention by the Government to any other magnetical or meteorological observatory in this part of Britain."

In several respects meteorology is looking up at the Royal Observatory; as illustrations we may quote the facts (1) that the photographic records of the thermograph and barograph, after years of practical oblivion, are being discussed; (2) that the eye observations taken each morning at 9 a.m., are now daily forwarded to and published by the metropolitan newspapers, thereby granting that which has so long been wanted,—the opportunity of comparing observations with those made at our national observatory. We trust that the several points which we specified, and a few other obvious and minor ones, will receive consideration, and then the Greenwich meteorological department, with perfect records for the time present, and unequalled ones for the time past, will be a worthy companion for the Astronomical Observatory.

Kew as a meteorological observatory has practically no published results by which it can be judged. No one who knows anything of

the facts will assign to Kew (prior to 1868) any higher rank than that of scores of meteorological stations scattered over the British Isles. We are not even aware that the observations made there have ever been published except in the columns of the *Illustrated London News*. Since 1868, it has been made one of the seven observatories of the Meteorological Office, but that provides it with no record of the past, no perfect record of the present, and no means of determining secular changes—for that we must look to Greenwich, and to Greenwich alone.

But these facts must not be considered as condemnatory of Kew. We merely contend that as a meteorological station Kew is inferior to Greenwich, primarily because of its recent organization, and secondly because it is in such a very low situation, only some 5 ft. above high water mark.

Kew, however, we cannot spare, and thanks to Mr. Gassiot's splendid donation, we need not fear its annihilation. Kew is most useful and necessary, and requires only one alteration—namely, development. If the Kew authorities had done nothing but help the Meteorological Committee to devise their instruments, they might have been content, but they have done very much besides, in constructing and supplying standard instruments, and in their careful verification of all that are submitted to them and granting official certificates, they have met a want which will, we trust, increase in an increasing ratio.

To sum up the whole argument, we consider that the two observatories have essentially divergent objects: to Greenwich we look for continuity of observation and information respecting secular changes, while we consider the aims of Kew should be verification of instruments, and original physical research.

REVIEW.

Handbook to South Africa, containing Map of Routes to the Diamond Fields, Physical Geography, Climate, and Resources of Cape of Good Hope and Natal, with an Introduction. By H. W. BATES, F.R.G.S. Post 8vo., 61 pp., and folding map. S. W. Silver and Co.

METEOROLOGY has, unfortunately, very little to do with diamonds, but the handy little manual before us not only gives a collection of reports by eye-witnesses of the rush to the banks of the Orange and Vaal rivers, but it also gives a general idea of the climate of that upland district, compiled by Mr. Bates from, probably, his own general knowledge and the records of travellers and sportsmen acquainted with the district. We may be quite sure that no meteorological observations are taken by diamond diggers, and they may, many of them, thank Messrs. Silver for giving them the best information obtainable as to the climate with which they may expect to have to contend. For full details we must refer our readers to the pamphlet before us, but as a rough indication we may just remark that the leading features appear to be drought, dust, and diamonds, great range of temperature, great heat, and occasional thunderstorms. Taken altogether the manual is useful and complete.

THE THUNDERSTORMS OF JUNE 17TH, 18TH, AND 19TH.

MIDDLESEX.

WINCHMORE HILL.—This district was visited by a series of violent, though very local thunderstorms, on the 17th, 18th, and 19th; on the 17th, distant thunder was first heard in S.S.W. at 4 p.m. 4.30 p.m., thunderstorm with very frequent and heavy peals of thunder; heavy rain from 4.30 to 4.50, amount .26 in.; thunder ceased at 5 p.m. This storm was very local, no rain having fallen three miles to the S. 18th. Heavy thunder in W. from 1 to 1.15 p.m., a few large drops of rain. 4 p.m. Frequent peals of thunder in S.W.; from 4.15 p.m. to 5.45 p.m., the thunder was peculiarly heavy, and perfectly incessant; vivid lightning at 5 p.m. At 6 p.m., the storm-cloud, which had been apparently coming right over from S.W., subsided with a S.E. current; no rain fell during the storm. 19th. Distant thunder in S.W. from 10 to 11 a.m. 1.30 to 1.33 p.m. Heavy shower, amount gauged .07 in. 1.35 p.m. Thunderstorm, bright lightning, and heavy thunder, till 1.50. Thunder ceased at 2.15 p.m. Rainfall very heavy half a mile to the eastward. The drops of rain on the 17th were of immense size, and fell in heavy fitful splashes.—*Thos. Paulin.*

PINNER HILL, WATFORD.—A most extraordinary rain-storm took place here between 4 and 5 p.m. on 18th. It lasted not more than half-an-hour in its intensity, although it rained for more than double that time. Situated as we are at a distance from a river, a flood with us is of very rare occurrence, but yesterday our ditches were suddenly converted into rivers six feet deep and 30 yards wide, garden walls thrown down, the traffic nearly stopped on the railway, the rails in some places being entirely covered with water, and immense damage was done to the standing crops of grass. The area of the storm seems to have been limited to a small district; at Eastcot, only a mile off, there was no rain at all. I fancy this house did not get the full force of the storm, but the amount I measured in my gauge was .93, or nearly an inch. This, in such a short time as an hour, is unprecedented in my records.—*W. A. Tooke.*

KENT.

WALTON HOUSE, EASTRY, NEAR SANDWICH.—On Wednesday, 19th, p.m., we had a most heavy rainfall. In a sudden squall, which lasted for 20 minutes or so, we had exactly an inch of rain. The hailstones which fell during the storm were large enough to break many panes of glass in the green-house and framing grounds here, and in other places in the village.—*J. Rae.*

HERTS.

BERKHAMPSTEAD.—We had but little of the thunderstorms which have been so heavy elsewhere. On the 18th there was thunder and lightning between 4 and 5 p.m., and heavy rain for a short time; and in the afternoon of the 19th we had similar weather. The rain on the 18th measured 0.13 inch, and on the 19th 0.11 inch. The maximum temperature on the two days was 87° and 86° 5.—*W. Squire.*

NORTHAMPTON.

BARTON SEAGRAVE, KETTERING.—I send you some particulars respecting the great storm of the 18th June. I may mention that on the 17th we had a severe thunderstorm at 7.15 p.m., during which the wind turned from S.W. to E.S.E., and 0.40 in. of rain fell. The morning of the 18th was hot and gloomy, and the day continued so, with a shade temp., max., of 86°, but no indication of storm until 3 p.m., wind continuing E.S.E. The storm rose almost more rapidly than I have before witnessed in S.S.W. I should imagine it extended from 14 to 15 miles, and was of an oblong form, oscillating when at its height between S.W. to W.N.W. I certainly have never seen anything approaching this storm in Great Britain. The rain seemed to be in flakes as large as my hand, mingled with pieces of ice. The storm lasted about five hours, and the amount of rain shown by the rain gauge was 3.62 in., but in my opinion the fall was much larger, as, owing to the hurricane which at times prevailed, the whole amount of rain would not be taken by the gauge. The wind continued E.S.E. during the storm, with fierce S.S.W. squalls at intervals, but remained S.E. during the night and a part of the following day. You will see an account in the *Times* of June 21st of this storm, written by myself, in which I mention that 3.22 in. of rain fell in less than three hours. I measured this amount when the fury of the storm was over, and have now given you the total fall (as far as I am able) during the storm. I should, however, imagine that at least 4 in. of rain fell in the five hours.—*J. Borlase Tibbits.*

KETTERING.—Very heavy thunderstorms occurred in this neighbourhood on Monday and Tuesday. The heat for several days had been very oppressive. Thunder was heard at intervals most of the day on Monday, but towards evening the clouds gathered, and about 7 o'clock the storm began in earnest, and for more than an hour and a half the lightning was most vivid and incessant, and the thunder loud and continuous. Considerable damage was done by the lightning in the neighbourhood of Pytchley. A valuable heifer belonging to Mr. Mash was killed in a field, and several trees were split and stripped of their bark. On Tuesday the storm commenced early in the afternoon, and raged with terrific violence until about 7 in the evening. Mr. J. Borlase Tibbits writes from Barton Seagrave, near Kettering, that the thunderstorm of Tuesday was the most severe that has occurred in the midland counties. Though the day had been oppressively hot, with a temperature of 86° in the shade, there was no indication of a storm until 3 p.m., when in the course of half an hour enormous cumuli of an inky blackness had risen in the S.S.W. For nearly three hours the storm raged with an intensity that Mr. Tibbits has never seen approached in Great Britain, the lightning and thunder being appalling, while rain and pieces of ice fell in sheets. In less than three hours the rain gauge showed 3.22 in. of rain. The damage by floods must be enormous, the whole valley of the Isle and Nene being one vast lake, and thousands of acres of mowing grass being entirely submerged. On the Midland main line some hundreds of men are employed in repairing the rails washed away near Rushton station, and numerous fatal accidents occurred.

NORTHAMPTON.—The heavy thunderstorm which broke over Northampton and county on Tuesday afternoon the 18th, caused great damage, and several lives were lost. At Overstone, a village about four miles distant, where is situated the country seat of Lord Overstone, the storm was very heavy, and trees and walls were in many cases entirely destroyed. The stone wall which encloses Overstone Park has been washed down for many yards, and the large coping stones, weighing

upwards of 2 cwt. have been washed into an adjoining field. All down the meadows at the side of the Nene for many miles the land is under water, and what hay was cut has been floated down towards the fens. Animals that were grazing were drowned. At Northampton the river overflowed its banks at the west end of the town, the residents in the houses being compelled to remove from the ground floors and live in the bed rooms, the furniture on the ground floor floating about the rooms. The pigs in the styes were in some cases drowned. A bridge over the river was also washed away, and a quantity of timber in the wharves adjacent to the stream washed from the moorings and sent down the stream. In one meadow a number of freemen's cattle were grazing, and some were lost. About one o'clock at night the members of the Volunteer Fire Brigade were called up to assist in getting horses and cows out of the raging waters. Several pleasure boats broke from their anchors and went down the stream. Three men managed to secure one of the boats and got into it, and were very soon capsized and drowned. Only one of the bodies has up to the present time been found. The foundations of an inhabited house in Church-street were also washed away, and the house had to be propped up with timber. In St. James's-end the people are living in their bedrooms, and communication with the town and suburbs in the west has been kept up by means of carts and boats.

WELLINGBOROUGH.—A very heavy storm of thunder and lightning passed over this town and neighbourhood on Monday night last. During the storm a great quantity of rain fell.

OXFORD.

MAGDALEN COLLEGE, OXFORD.—At the close of a week which will be memorable for the severity of thunderstorms and floods in the northern midland counties, and south-west of England, the remarkable freedom from such visitations enjoyed by Oxford may be of interest to you. On Tuesday, the day of the greatest disturbance, thunder was heard once or twice at a great distance. The day was fine, and the evening clear and tranquil. —*Edward Chapman.*

ESSEX.

BOXFORD RECTORY, COLCHESTER.—The rain commenced here at 5 p.m. on the 19th, somewhat heavy for about half-an-hour, followed by a quiet fall for about 2 hours after sunset; total .69.—*J Byng.*

HIGH RODING, DUNMOW.—No thunder-storm till 19th; first muttering at 2.23 p.m.; storm at its height at 2.53, when was the nearest flash, followed by the heaviest rain, and great fall of hail, or rather lumps of ice. Direction of storm uncertain—S.W. to N.E.? Wind during storm, E. Rainfall in about three-quarters of an hour was 0.72 inch. —*E. Maxwell.*

DORSET.

LYME REGIS, DORSET.—A thunderstorm with heavy rain occurred here on the 19th inst. It commenced about half-past 7 a.m., and lasted until 10 a.m, during which time 1.10 in. fell. The lightning came from N.E., and passed away to S.W.—*Henry Tucker.*

DEVON.

FORE STREET HILL, KINGSBRIDGE.—Kingsbridge was visited by a severe thunderstorm on the evening of the 18th and morning of the 19th. Distant thunder was heard in the S.W. during the afternoon, the atmosphere throughout the day being exceedingly oppressive. The

storm commenced about 6 p.m., and continued, with some intermission, until 4 a.m. of the 19th. At 2.45 a.m. the storm was very severe, the flashes of forked lightning being very vivid, with crashing thunder. From 2.45 to 4 a.m., the rain fell very heavily, the amount registered being 1.23 in. The storm gradually passed off towards the N.E.—*G. Fox.*

KINGSBRIDGE.—At Marlborough, a village between Kingsbridge and Salcombe, the lightning between seven and eight o'clock on Tuesday, struck a thatched cottage occupied by a labourer named James Andrews and his wife. The latter was absent, and Andrews, who had been standing at his cottage door while the storm was raging, turned to enter, when he became momentarily paralysed. The room appeared to be in a blaze, and an alarm was immediately raised that the cottage was on fire, as the thatch was blazing, but by timely assistance the fire was extinguished. It appeared from examination afterwards that the electric fluid descended the chimney, entered the bedroom, and shivered a wooden bedstead to splinters. It then ran to the kitchen, obtaining egress through the back door. It appears to have afterwards struck a pigstye, and killed a pig. Considerable damage was done to the telegraph wires, and at the Modbury Post Office the instrument smashed with a noise similar to the explosion of a gun.

NEWTON ABBOT.—The chimney of the dwelling-house of Mr. Moale, Newton Abbot, was very much damaged by the lightning, and a candlestick standing upon the bedroom table was hurled with great force across the room; fortunately no person was injured. Mr. Vicary also had considerable damage done to his tannery by the electric fluid and the heavy rain.

PLYMOUTH.—Plymouth was visited on Tuesday night by a terrific thunderstorm, which commenced at 6 p.m. and lasted 12 hours. Yesterday the lightning and thunder were very severe, and rain at intervals fell in torrents. The storm was heaviest between 2 and 5 a.m. on Wednesday. About the latter hour a horse belonging to Mr. Baston, mail contractor, while drawing the London mail from the railway station to the post office, was killed by the lightning. Several minor casualties are reported. Early in the evening of 18th 0.56 in. fell in 35 minutes, and on 19th between 4 and 5 a.m. 0.40 fell in 25 minutes.

LANDSCORE VILLA, TEIGNMOUTH, DEVON.—During the great storm of thunder and lightning the rainfall from 5 to 8 a.m., on 19th, was 1.44 in.—*M. Clark.*

WHITSTONE RECTORY, EXETER.—The remarkable thunderstorm of Tuesday, June 18th, left its traces here. In my rain gauge the amount of fall was 0.68 in. At the Devon and Exeter Institution, Cathedral Yard, Exeter, four miles east of my house, the fall recorded was 1.10 in.—*Wilse Brown.*

WIDDICOMBE-ON-THE MOOR.—Eighteen sheep, the property of Mr. John Hern, Scobitor, Widdicombe-on-the Moor, were killed by lightning.

WITHERIDGE.—At Witheridge, about four o'clock on Wednesday morning, the lightning set fire to the thatched house of Mr. Selley, a large cattle dealer and butcher. About £500 worth of wool was burnt and damaged, and the house and the one adjoining were destroyed. Eight sheep and four lambs in a field were killed by lightning.

BLACKTORRINGTON.—Two cottages were washed down at Blacktorrington, and the inmates escaped from the windows on planks.

CREDITON, at about half-past eight o'clock on Tuesday night, the street lamps not being lighted, was enveloped in dense darkness, which proved the precursor of a terrible storm of thunder and lightning that appeared to be raging in several parts at one time. The lightning first came from the south-west, and within a minute or two afterwards it darted in immense sheets from the south-east. Lightning just as vivid, but of a very blue colour, also came from

the north-west ; and altogether the scene was indescribably grand. The thunder and lightning continued with more or less violence during the whole night, but little rain fell until six o'clock, when for an hour it descended in torrents. During the night and morning a rain gauge at the vicarage registered very nearly seven-tenths of an inch. The storm has seriously deteriorated the value of an immense deal of half dried hay lying in the fields unsaved.

DAWLISH.—Among the other effects of the storm reported are six sheep killed by lightning, one of them worth £20, belonging to Mr. White, Westley Farm, Dawlish.

EXETER.—Exeter was visited by violent thunderstorms on Tuesday night. The premonitory flashes were seen shortly after eight o'clock, but the full force of the storm was not felt for an hour or more, when the lightning became extremely vivid and the thunder claps very heavy. Copious showers of rain fell about ten o'clock. The storm had passed away to northward an hour later. Shortly after midnight another storm came on, rivalling the first in fierceness. Flashes of lightning some sheet, others forked, followed each other in rapid succession for two or three hours ; the thunder was very violent, and the rain descended in torrents, being quite of a tropical character. It was remarked that much of the lightning was of a decidedly bluish tint. At five o'clock the storm which had meanwhile somewhat abated, was once more renewed. The lightning seemed to be stronger, or in larger flashes, than before, while the thunder was equally heavy. Just after six o'clock an extraordinarily vivid flash of lightning was witnessed, followed almost instantly by a crushing peal of thunder, which literally shook many buildings, and the sound of which was almost deafening. The lightning had the appearance of a huge ball of fire, from which a great fork darted to the earth in a direction perpendicular to the horizon. No accidents are reported in the neighbourhood of Exeter, although the storms were the fiercest that have been known in that favoured region for some years. The comparative freedom of Exeter from violent thunderstorms is attributable to the fact that it is situated between two ridges of high land—Haldon and the Blackdown Hill—both of which attract the clouds.

HOLSWORTHY.—Considerable damage to bridges was done in the neighbourhood of Holsworthy by the floods.

SIDMOUTH.—A thunderstorm of more than usual severity occurred at Sidmouth yesterday morning, the 19th instant. The temperature during the whole of the previous day was very oppressive, reaching $70^{\circ}2$ in the shade. About 8.55 p.m. the sky became overcast, dark heavy clouds came up from the south-west, a slight ripple appeared on the previously calm sea, followed in a few minutes by a flash of sheet lightning, which was succeeded by other flashes of a similar character for some hours. The barometer at 11.30 p.m. was 30.004. On the 19th, at 6 a.m., began a storm of thunder and lightning, which for the vividity of the flashes of lightning and the quick succession of the peals of thunder (resembling a continuous explosion of rockets), accompanied by heavy rain, bore more resemblance to a tropical storm than one in Devonshire. This continued till about 7.30, the rain till 9 a.m. The barometer fell to 29.888 ; thermometer, 68° . The quantity of rain that fell was one inch and one-tenth exactly.

TORRINGTON.—I think it right to inform you at once of the heavy fall of rain we had here on the evening of 18th and early on 19th ; my gauge had 2.83 in. The usual receiver was not large enough to contain the downpour, and there was nearly half an inch in the outside can. It was a series of thunderstorms ; one of the heaviest I ever saw, and one of the longest. The 18th was very hot. I was at Chittlehampton when a premonitory shower fell between 5 and 6 p.m., and lasted some considerable time. There was thunder, but not very near us. It cleared off, and at about 8 we started for home. We had not gone very far when I noticed some suspicious looking clouds to the southward, and by the time we had gone, say two and half miles, we felt

some warning drops, which soon quickened into one of the heaviest showers I was ever out in; flash followed flash, and peal peal, until we began to think of shelter, and found it in a farm-house on our way about two miles from where the rain had begun. We were weather-bound there for about two hours, when we again sallied forth, and reached home without more rain. But there was a heavy bank of cloud to the westward, which proved itself full of electricity, for at about 1.15 a.m., the storm began again, and continued with greater or less intensity for some five hours. The lightning was sometimes rose coloured, sometimes blue, and some of the rolls of thunder were most unusual, one with a quick vibration like the roll on the small drum, another a simple explosion like that of a cannon. The Post Office battery is injured, the intensity coil being damaged. I fancy that the wire which is attached to the spire was struck, or else the conductor which comes from the vane. I hear that the telegraph wire between Bideford and Appledore is also injured. The river is in full flood, some six feet deeper than it was yesterday morning—*Sam. Buckland.*

P.S.—The storm I encountered *en route* was felt here, but I cannot give you time or duration.—*S. B.*

MESHAU, SOUTH MOLTON.—This neighbourhood has usually but little thunder and lightning, but on Tuesday evening, 18th, a very severe storm visited us, commencing about 7.30 p.m., and continuing with more or less severity till nearly 9 a.m., 19th. The rainfall then measured amounted to 1.15 in. The lightning was very vivid, and I am sorry to say struck a house in Witheridge, about four miles to the south of this place, and set it on fire; no life was lost, but the house struck was consumed, and an adjoining house much damaged. The course of the storm appeared to be from S.E. to N.W.—*W.H. Karslake.*

BARNSTAPLE.—The storm of rain and thunder here on 18th and 19th was more severe than had ever been experienced within the memory of the oldest inhabitant, and considerable damage was done in the neighbourhood. The rainfall in the ten hours amounted to 2.50 in. I observed with surprise that at 4.45 a.m., whilst the thunder was loudest the blackbirds, thrushes, and cuckoos, which abound in our grounds, continued to sing unconcernedly.—*Townshend M. Hull, F.G.S.*

BARNSTAPLE.—The storm passed away from Barnstaple and the neighbourhood about ten o'clock on 18th, but at two in the morning of the 19th, it came on with increased fury, and the main drainage works outside the river wall along the New Road burst with the report of a gunpowder explosion, about forty or fifty yards of the drain being destroyed. The drain had only recently been constructed at a cost of several hundred pounds.

BIDEFORD.—The second outburst occurred at about two o'clock yesterday morning, 19th. The claps of thunder were deafening, peal after peal followed each other at intervals of a few minutes, and the rain literally poured in torrents. So close were the electric clouds that the furniture in the houses shook, and great alarm was felt. The storm continued thus for several hours. The river Torridge was so swollen by the rain as to present the appearance of a tidal river. With the hail and rain the marsh grass has been laid flat and injured. Mr. Cole, of Lower Gunstone, was riding over the bridge when his horse was struck down by lightning. The leg of the rider was injured, but the horse was unhurt. Several cases of cattle killing and destruction of trees are reported. At Appledore the telegraph wires were broken.

CORNWALL.

HEXWORTHY, LAUNCESTON.—The rain registered here during the storms of 18th and 19th was 1·72.—*H. M. Harvey.*

ROBOROUGH (E.S.E. of Great Torrington, five miles).—The storms about six o'clock of the 18th seemed to approach from the S.W. and S., and met over the Great Torrington district. About ten o'clock it became fine, but a violent storm came over again about one o'clock, a.m., of the 19th, and continued until five o'clock, when rain descended in torrents ; the lightning was very blue.—*H. M. Harvey.*

SOMERSET.

BINCOMBE HOUSE, CREWKERNE.—On Tuesday night, 18th, at sunset, heavy clouds began to rise, and it lightened all night, but no rain fell until Wednesday, at 7.20 a.m., when it began, and in one hour and forty minutes I measured 0·73 in. ; it ended at 11.15 a.m., when 0·29 in. more had fallen, making 1·02 in. all together.—*F. J. Sparks.*

WIMBORNE STATION.—This part of the country is rarely visited by thunderstorms of any great severity ; this I have specially noticed for some years, and in this case we were singularly exempted from a visitation. On the 16th and 17th the heat was excessive, and there was no variation in the barometer worth recording ; towards 2 p.m. a distinct ponderous thunder-cloud rose in the south, remarkable for its isolation ; the sky being at this time remarkably clear, I noticed the hard and strong outlines of this cloud, also noticed its rapid increase and development, and felt certain that a great storm was impending ; it maintained its position, however, and at 4 p.m. had passed into a modification of ordinary cloud stratus, followed by a rack of detached "mackerel" clouds, which disappeared in the zenith ; no lightning was visible at night, and the moon rose clear and brilliant. I heard in the evening that thunder had occurred at Weymouth, with slight rain, and also that a storm had burst in the Channel south of Portland ; this then was the storm I had noticed rising over the line of hills which run east and west from Swanage towards Dorchester, being due south, looking from Wimborne, my post of observation.—Tuesday, the 18th. Heat still exceedingly oppressive ; the sky nearly overcast with a filmy, hazy, cloud canopy, which at 10 a.m. was relieved by a lower formation of hard marble cirro-cumuli, with no perceptible motion, but nevertheless with a gradual clearing in the direction of the sea (east) and an increasing density towards the west ; at noon the sun shone with tremendous power and with a comparatively clear sky, which maintained itself throughout the afternoon, and I particularly noticed the absence of those electric indications which were so evident in the early part of the day. At 6 p.m. I noticed thunder cumuli in the E.N.E. very distant and isolated, and it was not until 9 p.m. that any real manifestations of great change were apparent. Due west at this time an immense bank of cumulo-stratus, throwing up anvil shaped projections, rested upon the horizon, broken here and there with towering "heads" of extreme density in

grand relief against a deep orange-tinted background ; across the moor (due S.) patches of cloud in detachments worked up from the S. At 9.30 p.m., rapid flashes of lightning were visible in the direction of the Channel (E.), and more especially in the W. and N.W., but no rain fell, neither was thunder heard. The night passed quietly, but at 7 a.m., 19th, we were visited with heavy rain and a slight storm of thunder, which worked up from the S.E., and worked away to the N.W. Shortly after this a rapid scud was borne up with a N.W. wind, but I noticed that the upper layer of clouds was coming from the S., and that the clouds were very electrical in their formation and appearance. Rain fell heavily during the morning of the 19th. At noon the sky cleared bodily, and in a short time clouds of a different character altogether (the "nimbus") rose from the N.W., with a fall of 7° in temperature, and a brisk cool wind set in—the change had been effected.—*E. J. Gale.*

BATH.—Yesterday morning a violent thunderstorm broke over Bath and the surrounding neighbourhood, lasting with more or less severity for one or two hours. The rainfall was very heavy, and was accompanied by many flashes of lightning and peals of thunder. The storm fell without any warning of its approach, the morning having been fine. No damage of moment was the result.

GLOUCESTER.

CIRENCESTER.—About noon on 18th, thunder was heard in the west ; it continued for two hours, and then seemed to pass away to the north-west. Light clouds hanging about, but no rain at Cirencester, and none apparently to the east of it. We were evidently at the eastern edge of the storm ; there was rain at Stroud and Gloucester, and the storm there appeared to be travelling up the vale of the Severn. On 19th there was a storm very similar to that of the previous day, and it seemed to hang about in the same place, but part of the storm just touched us, and 0.31 of rain fell in the storm, and a little drizzle that followed. There must have been a great deal of rain to the west of us, but not much to the east, and we were, as before, at the eastern edge of the storm. It began about 10 o'clock in the morning, and thundered for about an hour.

HUNTLEY.—The storm on 18th commenced from the southward, at about five minutes to 12 o'clock, and to five minutes past showering of hailstones and water were continuous ; from five minutes to 12 till lull in storm at 12.15, rainfall 0.29. A fresh storm commenced about 0.20 p.m., and at 1 p.m. rain measured .52 in. The storm passed off to the northward, working round to the eastward, coming overhead again about 2.30 and 5 o'clock ; additional rainfall to 9 a.m. 19th, 0.35 ; total in 24 hours, 1.16. Hailstones were pip-shaped and round, the larger ones averaging three-quarters to an inch long and half-inch broad, and the lesser about half-inch in diameter.—*W. L. W. Eyre.*

UPFIELD, STROUD.—Yesterday, 18th, a heavy thunderstorm passed up the Vale of the Severn towards Gloucester and Malvern, commencing about 12 a.m. The amount of rain that fell here during the storm was .31. At Stroud, a mile to the east of us, none fell, and up

to 5 o'clock p.m., no rain had fallen at Cheltenham, merely the edge of the storm passed over us. It thundered heavily all day to the N.W. of us. At 8 a.m. on 19th, another thunderstorm passed up in the same direction, from the S., the amount of rain for the 24 hours at 9 a.m. being 0·85 ; greatest heat yesterday, 85°.—*B. Stanton.*

SHROPSHIRE.

BUILDWAS.—A heavy storm, which came up rather suddenly on Wednesday morning, was accompanied by a fall of rain to the amount of 1·07 inch, nearly all of which fell in the space of about an hour.

OSWESTRY.—At Oswestry, some farm buildings and wheat stacks were fired, and two men injured.

ELLESMERE.—Farm buildings and haystacks were set on fire near Ellesmere.

STAFFORDSHIRE.

THE LYONS, ENVILLE, STOURBRIDGE.—My observations for the two days are as follows :—

Date.	Barometer.	Wind.	Weather.	Rain.
18th.....	29·92 ...	S.S.W. ...	{ det. cl., distant thunder, great storm at Birmingham and elsewhere.	{ .00
19th	29·78 ...	S.W. ...	det. cl., thunder storm from W.	... .02

I may mention that my house is situated on the slope of the high ground called the Sheepwalk, about 15 miles N.W. from Birmingham.

—*Robt. S. Edwards.*

WALSALL.—On Tuesday a mother and child were killed by lightning near Walsall. Another child in the mother's arms escaped unhurt. The husband and father, who was standing by, was also struck, but not seriously hurt.

WORCESTER.

LANSDOWNE, EVESHAM.—No disturbance whatever here, Tuesday, 18th instant. No rain ; distant thunder in N.W.-N.E. a little distant lightning seen. Wednesday, 19th. Short sharp showers in forenoon ; no lightning or thunder. Total rain ·23 in. River flowing past here rose four feet in the night, being *unusually turbid*, indicating much rain north of this. Both days heavy electrical cumuli, with wild interlaced cirri and cirri-stratus. Barometer steady, 29·900 ; thermometer, max. Monday 17th (85°) ; Tuesday 18th (86°·5).—*R. Burlingham.*

MOSELEY, BIRMINGHAM.—The fall of rain in this district on 18th was very erratic, as will be seen from the following deductions : Moseley (Thomas L. Plant), 2·47 in. ; Bloomsbury street, (D. Smith), 1·23 in. ; Edgbaston (Latham), 0·81 in. We had another storm on the 19th, when the rainfall at Bloomsbury-street was 0·64 in. and Moseley 0·46 in. The distance of the two places from Stephenson-place (the centre of the town) is about the same, two-and-quarter miles ; directions, Bloomsbury-street E.N.E., and Moseley, S.S.E. The distance from Moseley (Park-hill) to the Botanical Gardens, Edgbaston (Mr. Latham), is about two-and-a-half miles, E.S.E. to W.N.W.—*T. L. Plant.*

ORLETON, TENBURY.—A terrific thunderstorm burst over here on the 18th. The preceding three days had been very fine and hot, the ther. rising on the 17th to 80°·6 in the shade, fully protected. Soon after noon on that day a lofty plate of dusky rain-clouds gradually obscured the southern part of the sky, and cleared away again after 4 p.m., leaving large piles of cumuli in the eastern horizon. The morning of the 18th was very bright and hot, the ther. reaching 83°·2 in the shade; soon after 12 the southern part of the sky filled with lofty cumuli, and distant thunder commenced, rapidly approaching. From one till half-past one p.m. the lightning was very brilliant and frequent, followed at very short intervals by deafening peals of thunder, and a great fall of rain, mixed with some hail. The violence of the storm then abated, but increased again about a quarter before three o'clock, and did not pass away till half-past three p.m. About half-a-mile from this place a fine double elm tree was struck by the lightning, and three large fat oxen which lay under it were instantly killed. About two miles distant, three cows which were sheltering under a tree were killed in a similar manner, and within a radius of one-and-a-half miles from the centre of the storm, seven or eight trees were struck by the lightning, and one of them, a large oak tree, nearly stripped of its bark. Viewed from a distance of twelve miles to the north, where there fell no rain, the great plate of cloud from which the thunder proceeded appeared to be very lofty, and shaded off at the edges into a clear blue sky, below which, on the horizon, to the west and north, were grand piles of cumuli, the nucleus of other storms. On the following morning, the 19th, another great thunderstorm passed over this locality, commencing soon after nine a.m., and was accompanied by a great fall of rain. On the 18th, the fall was 0·65 in., and on the 19th, 0·76 in., making together 1·41 in. On the 24th another heavy thunderstorm passed over us, with a fall of 0·61 in. of rain.—*Thomas Henry Davis.*

WARWICK.

SOUTH WARWICKSHIRE.—The thunderstorm in South Warwickshire yesterday caused immense damage to property over an area of about 30 miles. The weather in the early part of the day was clear, but exceedingly sultry, and continued so up to midday, when dark clouds overspread the western part of the sky. Heavy peals of thunder commenced at 2 o'clock, and shortly afterwards the rain descended almost in sheets of water. At Bishop's Itchington a large hay-rick, the property of a Mr. Pearson, was struck by lightning and set on fire. At Hatton, large hail-stones fell for a long time, and in some cases broke the windows of dwellings in the same district. The water courses were inadequate to take away the water, and many of the fields were submerged five and six inches deep. The fury of the storm was intense in the Henley district, where in some instances the roads were flooded some four, five and six feet, and many of the inhabitants were compelled to take refuge in the upper parts of their dwellings, in consequence of the water in the kitchen and basement stories. One horse was drowned. It is feared there has been great destruction of property.

HENLEY-IN-ARDEN.—In less than two hours, 3·41 (or nearly three and a half) inches of rain and hail fell at Henley-in-Arden, and during the first 55 minutes a rain gauge registered no less than 2·74 (or two and three-quarter) inches. incessant sheet lightning and thunder accompanied the storm. The unusual maximum temperature was, on Tuesday, 84½° in the shade.

BIRMINGHAM.—Mr. T. L. Plant writes :—"The storm which visited Birmingham and vicinity on Tuesday last, 18th, came from the south, the greatest severity of which was felt at Henley-in-Arden. At Birmingham the tempest began at 1 p.m. Shortly before 2 o'clock, and for half-an-hour, the rain was mingled with immense pieces of ice, three-quarters of an inch to an inch and upwards in length, and of most irregular shape. The storm lasted $3\frac{1}{2}$ hours. Rain fell at Moseley ($2\frac{1}{2}$ miles from the centre of the town), 2.47 in. This is the largest quantity of rain I have registered, and fully $1\frac{1}{2}$ in. fell in three-quarters of an hour between 1.50 and 2.35 p.m. The greatest recorded rainfall in Birmingham in the shortest space of time was in the evening of Sunday, July 6, 1845, when 1.95 in. of rain fell in less than half an hour, and was registered at the Birmingham Philosophical Institution, Cannon-street." On Wednesday forenoon, 19th, soon after ten o'clock, the scene of the previous day was re-enacted, and thunder, lightning, and torrents of rain burst over the town in undiminished fury. Since the visit of the Queen to Birmingham, in 1858, no storm to equal that of the last two days has been experienced in the district, and the fall of rain has surpassed that during any previous storm on record. Several thousand pounds of damage has been done to houses in the lower part of the town, and wherever an immediate exit could not be found to the volume of water which fell. Hundreds of gardens in the suburbs are reduced to shapeless masses of mingled earth, gravel, and uprooted vegetation. The macadamised roads in the outskirts of the town present the appearance of the dried-up beds of mountain torrents. The hailstones have done serious damage to glass, the windows of many dwellings presenting the appearance of having suffered from musketry fire. Two houses were struck, the chimneys were thrown down, and some parts were carried a distance of thirty yards. The electric current passed into one of the houses, carrying away the chimney-piece and smashing the ornaments thereon. Mrs. Gritten, the occupant of the house, and her infant, three months old, were in the room, but escaped unhurt. Mingled with the rain, which descended at times in sheets, were hailstones of enormous size. The little river Rea, which traverses the town, overflowed its banks in several places, and all the low lying parts were temporarily flooded. No fatal accidents are reported, but the damage to property, and especially crops and garden stock, is considerable. In Norfolk-street a torrent of water poured down from the tunnel under the canal, and in a few minutes the houses were three to four feet deep in water. New-street station was also flooded to the depth of two feet. Considerable damage is done to fruit and cereal crops.

LEAMINGTON.—Yesterday morning, 19th, two violent thunderstorms passed over Leamington and neighbourhood, which escaped the full fury of the storm of the previous day. About 11 o'clock the electric fluid struck the shop of Mr. Jones, trunkmaker, Bath-street. How it entered cannot be discovered, but it made its exit into the main street through a door, a thick square of plate-glass in which was shattered into fragments. Portions were fused, and had evidently been subjected to intense heat. A cottage in Springfield-street was also struck during the second storm shortly after midday. The lightning struck the chimney and entered the earth. Several hairbreadth escapes are reported, but no serious casualties. During both storms, which lasted a considerable time, the thunder was loud and sharp, immediately overhead, and the lightning remarkably vivid and often forked. Rain fell in torrents, and the streets were literally flooded. The afternoon and evening were close and oppressive, but without serious electrical disturbances.

LEAMINGTON, (another account).—A second thunderstorm occurred here on 19th, and continued about two hours, during which time there was heavy rain and incessant thunder, with forked and sheet lightning of extraordinary grandeur. At ten a thunderbolt fell in a yard at the back of a house in Bath-street, occupied by Mr. Jones, portmanteau manufacturer. It entered his premises through an open back window, and, passing into the shop, ultimately struck a large sheet of plate glass in the front door, and shattered it into innumerable fragments. Mr. Jones and two ladies near the door narrowly escaped. The shop was filled with a sulphurous smell long after the occurrence. The glass was made quite hot by the electric fluid.

LEICESTER.

BELMONT VILLAS, LEICESTER.—On Monday evening, the 17th, much distant lightning was visible, and on Tuesday we were visited by a most fearful storm, which commenced at 4.30 p.m., the rain being heaviest from 5 to 5.30; very little fell after 5.45, but the thunder and lightning kept on incessantly till 8 p.m., and seemed to be overhead for so long a time. The storm was heaviest at Market Harborough, about 15 miles S.E. of here; it was also very heavy in the Peak of Derbyshire. Greatest heat—June 15th, 82.2; 16th, 81.2; 17th, 87.2; 18th, 86.5; 19th, 78.2. Rainfall at Belmont Villas, June 18th, from 4.30 to 5.45, 1.22 in.; June 19th, 0.56 in. At Freeman's Common—June 18th, from 4.30 to 5.45, 1.11 in.; June 19th, 0.46 in., which fell in a little more than an hour.—*Henry Billson.*

MARKET HARBOUROUGH.—One of the heaviest storms of rain, lightning and thunder that has ever been known here occurred on Tuesday. Probably the streets never before so rapidly presented the appearance of a sea, the whole space from causeway to causeway being some depth in water. The principal roads were impassable except by conveyances, and the cellars of houses in the lower part of the town were flooded. The Sheep market and the space from above Lubenham-lane, Northampton-road, and St. Mary's-road was one sheet of water, and a quantity of posts, &c., which were lying for sale on the gravel were soon floating about. Had the river Welland been full, the state of things would have been much more serious. It was at one time thought that the Folly-pond had burst, so great was the body of water that came from it; but on going to the spot, it was found that the pond was only overflowing its banks. At the Swans hotel, a fire-engine had to be engaged to clear the cellar of water. It was reported that at Little Bowden two men had been drowned, but this, we believe, is incorrect, as we understand the men who had got into the stream were rescued, although with great difficulty. [We are informed by a correspondent residing in the neighbourhood that one man *was* drowned.—E.D.] Trains on the Midland railway were unable to pass for some time, owing to the great body of water which flowed on to the permanent way. We hear that Mr. Cox gauged the rainfall between 4.50 p.m. and 7.50 p.m., and found it no less than 4 inches.

RUTLAND.

RUTLAND.—A terrific thunderstorm burst over this county on Wednesday, lasting for several hours. At Caldecote it was very severe. The Sun inn, at Great Easton, was struck by the lightning. A sheep was killed, and an oak tree near the village was completely split from top to bottom. A large elm growing at the back of the gardens at Bisbrook Hall was on Tuesday evening struck by lightning. The electric fluid passed from one of the top branches down the trunk to within a foot of the ground, tearing off a strip of bark three or four inches wide, and some of the fragments were scattered twenty yards from the tree. At Wymondham, the lightning and thunder were perfectly alarming. A tree was struck at Teigh; at Sproxton part of a house was knocked down; and a sheep and a beast were struck.

LINCOLN.

ALFORD.—A terrific thunderstorm burst over Alford at 1 a.m., on Tuesday, and continued until three o'clock, when it seemed to have passed over in a north-easterly direction. The rain fell in torrents, and the lightning was both frequent and vivid. Happily, no more damage in the town was done beyond a few trees being shattered, but in the neighbourhood there were more serious results. At Belleau, on the farm of Mr. Tom Young, three valuable sheep intended for a prize show were killed as they lay together under an ash tree; and a calf and a

young horse were injured. At Fordington, on the farm of Mr. Geo. Cartwright, the shepherd and his wife and child had a very narrow escape. Disturbed by the storm they left their bedroom, and went into the kitchen, where they were almost immediately struck down by lightning, and rendered apparently lifeless. The electric fluid entered by the chimney, and in escaping set on fire a cupboard full of clothes, scorched a pillow upon which the child had lain, and shattered the window panes. A saw which was hanging on a wall was shivered to pieces, and a metal candlestick was melted. The Forrel Farm, at Bilsby, belonging to the Rev. J. Allott, and occupied by Mr. Drewry, was also struck by lightning. The chimney stack was damaged, and some tiles were scattered, but no one was injured. A cottage called the Old Rectory, at Sutton, occupied by David Holmes, was set on fire by a flash, but not much harm was done.

BOSTON.—A terrific thunderstorm passed over Boston and the neighbourhood about midnight on Monday last. The lightning was unusually vivid, and the peals of thunder were very loud. At Sibsey, and some places north and north-east of that parish a good deal of damage was done; instead of rain, as at Boston, there was a heavy fall of hail. The windows of several houses were broken, and the wheat and potato crops were much injured. A horse, valued at £50, the property of Mrs. Arlice, of the East-fen, was killed by the electric fluid while grazing in a field, as also were two sheep belonging to Mr. Cawdwell, of Leake. Several trees were more or less damaged by the lightning.

GRANTHAM.—On Monday evening this district was visited by a very severe thunderstorm, during which a youth named Peck, residing in Grantley-street, was struck by lightning. He was conveyed home, and medical aid was promptly obtained, but he continued insensible until about noon on Tuesday; he is now progressing favourably. Another storm on Tuesday was very severe, the rainfall being extremely heavy. Most of the houses lying low, or at the foot of a declivity, were flooded, but no serious damage was done.

HORNCASTLE.—On Monday night and early on Tuesday morning Horncastle was visited by a tremendous storm. The lightning was extremely vivid, and the crash of the thunder was occasionally appalling. Torrents of rain fell, and also hail. We have not heard of any damage being done in the neighbourhood. The storm did not have the usual effect of cooling the air, for the heat on Tuesday was most oppressive.

LINCOLN.—Heavy thunderstorms were experienced at Lincoln on Monday night and Tuesday evening. On the latter day the heat was intense, the thermometer standing at 83° in the shade.

LOUTH.—After two days of excessive heat, closely following upon cold March-like weather, a storm of unusual severity broke over Louth and its neighbourhood on Tuesday morning last shortly after one o'clock. The thunder was so loud and the lightning so vivid, that many were awakened from slumber in no little alarm. Heavy rain and hail fell during the progress of the storm, which continued nearly three quarters of an hour. After its cessation the atmosphere was brilliantly lighted up for an hour by sheet lightning.

SPALDING.—The lightning was very vivid, and but little rain fell. Six sheep on the farm of Mr. Fletcher, at Weston, were killed by the lightning. On Wednesday afternoon another heavy storm broke over the town, and for about half an hour rain descended very heavily.

SPILSBY.—On Monday night the town and neighbourhood of Spilsby was visited with a terrible storm. During the whole of the evening continuous peals of thunder in the distance were heard. These waxed louder and the flashes of lightning became more vivid as the midnight approached, until at length the elemental war burst upon the town in all its fury. Rain fell in torrents, flashes of lightning, chiefly of the description called sheet lightning, followed each other, from every part of the heavens, in immediate and rapid succession, ever and anon giving to the landscape the brightness of day. The peals of thunder were remarkably loud, louder indeed than had been heard here before for many a day. With the exception of the splitting of an oak gate-post in a field occupied by Mr. Pool Baker, we have heard of no damage having been effected. The storm appears to have been productive of more injury in some of the adjoining villages

than in the town itself. Captain Preston, of Dalby Park, had a ewe killed. A field of beans, belonging to Mr. J. B. Parish, of Toynnton All Saints, was much damaged, as also was one on the farm of Mr. Croft, of the same place. All were, however, insured. During the same night a horse belonging to Mr. Spence, of Toynnton, was killed, while depasturing on the Hobhole drain-bank. The church tower of Harrington was slightly injured by the lightning, and a magnificent oak on the property of the Rev. Langhorne Burton Burton, was rent and barked from top to bottom.

NOTTINGHAM.

NOTTINGHAM.—A terrible thunderstorm passed over Nottingham yesterday afternoon. James Carter and a friend, who had been fishing in the River Trent, sheltered under a neighbouring oak tree, when the tree was struck by lightning, stripped of its bark, portions being found 50 yards off, and Carter killed instantaneously. The other man was not hurt. A house occupied by Miss Shireliff, on Trent road, was struck, the lightning passing down the chimney and escaping out of the door. The roof was much damaged, but the occupants were not injured beyond being shaken. Other smaller accidents happened. Mr. E. J. Lowe, writes from Highfield-house Observatory, Nottingham, that on Tuesday the temperature in the shade reached 90·2 deg. at noon. At 2 p.m. distant thunder was heard, and from 3.25 p.m. till 4 o'clock there was a violent storm, during which above half an inch of rain fell. The storm passed over in a S.S.E. current, and was apparently more violent south of Highfield. At first the thunder and lightning were most remarkable, for when quite overhead the lightning was scarcely visible and the thunder nearly inaudible. At 3.42 p.m. there was a change in the singular character of the storm, the lightning becoming very vivid and the thunder loud. At 2 p.m. the temperature was 87·5 deg., the wet bulb being 14 deg. lower; at 3 p.m. the temperature was 81 deg., the wet bulb being 8 deg. lower; and at 3.50 the temperature was 65 deg., the wet bulb also reading 65 deg. After 4 p.m. the rain was slight, but continued; and the thunder and lightning did not cease till midnight. In the town a youth, while at work at a printing press, was struck and seriously injured, being conveyed home insensible. Other casualties are reported.

NEWARK.—The storms of Monday and Tuesday were heavy at and around Newark. The atmosphere was oppressive on both days, and on Tuesday the lightning and thunder, which lasted about three hours, were terrific. Several trees were struck by the electric fluid, and some of the crops were damaged. A very refreshing rain fell.

WORKSOP.—A heavy thunderstorm passed over Worksop between three and four o'clock yesterday. Hail stones of great size fell, and the lightning was very vivid. The thunder was fearful. Some poplar trees in Gateford road were struck by the lightning.

DERBYSHIRE.

DERBY was visited by a very heavy thunderstorm, or rather a series of storms, which lasted from about three o'clock until after midnight, with but little intermission. The first storm was at its height about five o'clock in the afternoon, when the flashes of lightning were frequent, and the thunder almost a continuous roll, the rain at the same time falling heavily. Between six and seven o'clock, there was a slight abatement, but about eight o'clock the heavens again became darkened, the thunder rolled, and a great downpouring of rain followed. It was not until after twelve o'clock that the storm had abated. About half-past five o'clock a vivid flash of forked lightning struck a stack of chimneys on the top of the house occupied by Mrs. Griggs, 6, Darwin-terrace, hurling a mass of bricks and large stones on the roof of the adjoining house, No. 7, occupied by Mr. Geo. Hibbert. The roof of this house was much shattered and was penetrated in several places, freely admitting the downpouring rain into two of the bedrooms. The bricks and stones next fell into the yard at the rear of No. 6, with a fearful crash, causing the greatest consternation to the occupants of both houses, but fortunately no one was injured. At No. 8 of the same terrace, occupied by Mr. Thomson,

the shock to the buildings caused nearly the whole of the plaster ceiling in one of the sitting-rooms to fall from its position, the rafters being left exposed. On Wednesday a second storm burst over the town shortly after noon, but was not so severe as those of the previous day, not lasting more than three-quarters of an hour. The continuous heavy rain caused the river Derwent to rise rapidly to a great height, to become a rushing, mighty torrent, and to overflow the banks and meadows on its course. It is feared that much damage will be done to the growing crops in its vicinity.

CHESHIRE.

CHOLMONDELEY, NEAR NANTWICH.—My rain gauge showed 2·08 in. of rain on the 19th, at 9 a.m. It fell in a few hours between 4 p.m. and 12 p.m. on the 18th.—*E. Leader Williams.*

NORTHWICH.—I gauged 1·85 in. to 9 a.m., 19th; on the 19th another storm fell of about 0·55 in. We had a great flood in the rivers Dane and Weaver.—*E. Leader Williams.*

USEFUL KNOWLEDGE SOCIETY, MACCLESFIELD.—An extraordinary fall of rain (for this district), accompanied by thunder every few minutes for 12 hours, occurred here on 18th, namely, 4·27 in. I have searched our register (which commenced in April, 1850) through, and cannot find an instance of even half that quantity falling in the space of time. Our ordinarily insignificant stream passing through the town has, of course, swollen to such an extent as to cause serious damage in several of the lower parts of the town.—*W. Jeffery.*

CREWE.—A terrible thunderstorm visited Crewe, lasting several hours, rain falling in torrents and flooding the thoroughfares. About 6 p.m. the electric fluid struck the Victoria Inn, Victoria-street, entering a bed-room by the chimney and window. The glass of the window was smashed to pieces, and the woodwork splintered. The floor of the bed-room was also torn, and an opening through into the bar parlour below was made big enough to admit a man's body. The curtains of the bed in the upper room were set on fire, and Mrs. Gartside, the landlady, who was dressing at the time, was knocked down and injured. The cries of the injured woman soon brought assistance, and the flames about the bed were speedily extinguished.

HEATON CHAPEL.—For nearly an hour, after 1 p.m., on 18th, vivid lightning and thunder prevailed, being accompanied by heavy rain, and unusually large hailstones. Some of the latter were larger than a pigeon's egg, and broke a large amount of glass in the neighbouring greenhouses, besides injuring plants in the open air. Up to a little after six o'clock it continued fine, but all at once thunder and lightning came again worse than ever, being followed by violent dashing rain, which up to 10 o'clock amounted to over one and a quarter inch, while that for the noon-fall was nearly half an inch.

MACCLESFIELD.—It is stated from Macclesfield that a storm unprecedentedly furious raged from six till midnight yesterday. The canal burst its banks and many hundred hands are out of employ.

NORTHWICH.—A very serious flood occurred at Northwich yesterday, doing considerable damage to property. The river Weaver overflowed its banks during the night, and High-street was flooded to the depth of four or five feet during the day. At 8 o'clock p.m. the water was still rising. Underground cellars are full of water, and shops on each side of the street are flooded very seriously, great damage being done to the stocks. The occupants of several lock-up shops were fetched out in boats, which are sailing in the street. Shortly after noon the River Dane overflowed its banks, and the fields and roads for a long distance were flooded. A sitting of the Northwich County Court was being held at the time in the drill-shed, and in a short time the building was surrounded with water to the depth of two and in some places three feet. The floor of the room was flooded to a

considerable extent before the business was adjourned. The occupants of the room had taken refuge on the forms. Some of the people got through the window, and, walking along some iron hurdles and walls, got away. The Judge and the Registrar were fetched away in a trap, others waded through the water, while several of the attorneys were carried out of the place and through Leftwich-road on the backs of boatmen and others. One or two rafts were also improvised and used. Persons were conveyed along the roads in carts and conveyances all day. A great many houses are flooded. Fortunately no serious accidents occurred. The salt works at Anderton and Winsford were flooded, and the fires put out. At the latter place a child was washed out of a house at 12 o'clock at night, and drowned. The other members of the family were only rescued by men going into the place with ropes tied round them.

LANCASHIRE.

WALTON-ON-THE-HILL, LIVERPOOL.—Tuesday morning (18th) opened magnificently, but with a rapidly-falling barometer; temp. in shade, 75° at 8.15 a.m.; wind S.E. It continued hot and fine till 1.20 p.m., when clouds (immense and black) began to make their appearance in the S.W. At 1.30 p.m. the first storm began, and lasted till 2 p.m., at which period it began to moderate, having been exceedingly severe. Distant thunder from 2 p.m. to 4 p.m., at which time the second storm began (I was not able to measure the fall of rain after the first storm was over, being in town at the time): from 4 p.m. up to 5.50 p.m.: the storm was terrible in the extreme, and enormous quantities of rain (but no hail) fell in, so to speak, spasmodic showers. I arrived home from town at 6.5 p.m., and measured the rainfall at once, and found it to be .77 in., the whole of which, I was told, had fallen in less than an hour and a half. Another slight storm occurred at 7 p.m., with a perfect deluge of water, which, however, only lasted a few minutes. Next morning the rainfall was .29 in., making a total of 1.06 in. for the day of the 18th. The barometer, which fell for two days before the storm, continued comparatively steady at about 29.81 in. (corrected and reduced to sea level) while the elemental turmoil was going on. The Wednesday morning was again close, and heavy, but not quite so warm. At 11 a.m. thunder was first heard, and continued with slight intermissions for upwards of two hours; only about .20 in. of rain fell in this storm.—*Arthur R. Andersson.*

ASHTON.—At Ashton the flashes and thunder claps were rapid in succession and very severe. Hail, snow, and rain fell in abundance. The electric fluid entered the residence of Mr. Councillor N. B. Sutcliffe, Tudor Cottage, Ashton, by the chimney, but beyond injuring the outside of the stack and filling the house with soot, did no damage. The thunder claps were so heavy that in several houses the windows were shaken out of their frames.

BURNLEY.—At Burnley the thunder was most severe, and the lightning vivid and constant. The rain fell in torrents, and flooded the low-lying districts. The electric fluid struck a factory chimney in Burnley Wood, and a house in Padiham. At the latter a quantity of crockery was broken, but no further damage was done.

BURY.—At Bury shortly before one o'clock, the electric fluid was seen to strike the gable of the Star Inn, Freetown, kept by Andrew Crowther, and about 200 yards from the mill, where a few weeks ago about £200 worth of damage was caused by a storm. A portion of the chimney stack was dismantled, a part of the house unroofed, and a large hole driven through the brickwork into one of the bedrooms, the ceiling of which was broken for a space of three or four square yards. The only other damage done in the room was the smashing of some glass frames.

Almost simultaneously with this occurrence the lightning struck in at the front door, to the great alarm of some young women who were sheltering there, and made its way into the cellar. The coupling of a inch gaspipe near the meter was wrenched away, and the gas that rushed from the pipe became ignited. This, however, was soon discovered, otherwise the house would have been set on fire. No person was injured—those at the door and in the passage were simply dazed. Upon the bedroom being opened, it could scarcely be entered, so oppressive was the sulphurous nature of the atmosphere. The electric fluid also struck the house No. 40, in Cecil-street, The Mosses, occupied by Edward Rigby, a mechanic. The building was struck in much the same way as the Star Inn, the chimney on the gable being split, and a hole driven through into the bedroom. Several lengths of gilded picture-frame wood were reared against the wall near the chimney, and the lightning set on fire the paper in which the wood was wrapped. The wall on the opposite side was rent, and a line left on the plaster similar to what might be expected from the firing of a train of gunpowder. The gilt framework wood was charred and spoiled. Rigby's wife and children were in the house part, and the little boy was lying asleep on the sofa, off which he was hurled to the floor. The damage in other parts of the town consisted of broken skylights, mirrors, the sweeping of ornaments off mantel pieces, &c. The storm at noon, which continued about half an hour was succeeded by another at 6 o'clock in the evening, which continued with greater intensity for upwards of an hour. Such a breaking forth of the meteorological storm elements have never been witnessed in Bury for some twenty years back. Telegraphic communication along the railway was suspended for two or three hours, and that with Bacup was totally cut off from three o'clock in the afternoon.

LIVERPOOL.—A steam tug named the Knight Templar, while lying at the Prince's landing-stage, was struck by the lightning during the first storm, and the truck of the mainmast was carried away. The steamer Memphis, cotton laden, was also struck, and about 60 bales were destroyed by the fire which the lightning caused.

MIDDLETON.—At Middleton, the electric fluid struck the residence of Mr. Faulkner, dyer, of Hunter-street, partly demolishing the roof and chimney. The cornice and a number of ornaments in the front bedroom were thrown down and smashed in a thousand pieces. Several children were playing round the kitchen fire in the lower rooms at the time, and one, a child, was thought to be seriously injured, but after much exertion it was restored. A few articles of furniture were broken, and the fluid escaped by an open door. Trees were also torn up by the roots through the force of the storm, and the crops are said to be very greatly damaged.

OLDHAM.—At Oldham, the storm commenced about one o'clock, and continued till nearly two. The lightning struck Bell Mill, Mumps, and caught a large flagstaff on the roof, reducing it to splinters, and setting the fragments on fire. Fears were entertained of the fire being communicated to the cotton spinning rooms below, but several men who ascended the roof put the fire out. The engineer engaged at the same mill was sent with considerable force against the boiler fire-grate; while two operatives, following the line of a steam-pipe, were sent to the ground in contrary directions by the force of the fluid. No material injury resulted to the men. A young man in the service of Messrs. W. and A. Forsyth, spirit merchants, Yorkshire-street, while standing in front of the premises, was knocked down, and for some time was insensible. A beerhouse in Beaver-street, off Yorkshire-street, was also unpleasantly visited. The lightning passed down the chimney, taking with it a large quantity of soot. A house in course of erection, in Napier-street East, was also damaged. Several tiers of bricks were stripped off one of the walls, but, no one being near, no injury resulted. The telegraphic wires communicating between the three police stations were struck on a cotton mill in Bell-street.

YORKSHIRE.

BEVERLEY.—On Monday (17th) and Tuesday (18th), whilst the storms were raging in the west of the Wolds, we on the east side had

nothing more than darkness, distant thunder and lightning, and a few heavy drops of rain.—*Thos. Dyson.*

ACASTER SELBY.—At about four o'clock on Tuesday afternoon, when the storm was at its height, a labourer and his daughter, John and Sarah Dillon, the former sixty-eight and the latter seventeen years of age, were working together in a field in the occupation Mr. W. Stead, at Acaster Selby, and there being no other refuge near, they did what was possibly the worst thing under the circumstances, chose the shelter of a large oak tree in the field. Here they had not stood very long ere a flash of lightning struck them both to the ground, the father thereby meeting with instant death, and the daughter, on recovering from the insensible condition into which she had been thrown, suffering excruciating pain in her feet, shoulders, breast, and other parts of her body which had been struck by the electric fluid. She was totally unable to stand, no one was near to render any aid, and the poor sufferer had to crawl for nearly three-quarters of a mile on her hands and knees, in the pouring rain and mud, from the dead body of her father to the house of Mr. Stead, the farmer, for whom they had been working. Every assistance was rendered her, and on being brought to this city Mr. Marshall, surgeon, also attended her. Although severely scorched in several places she is in a fair way towards recovery. The body of Dillon was left at Acaster to await the coroner's inquest.

BARNESLEY.—Yesterday afternoon, 18th, a thunderstorm of a most terrific character, accompanied by a very heavy and continuous downfall of rain, did a great deal of damage. The flashes of lightning and peals of thunder were such as were never before experienced in the district. All the power-loom factories were entirely stopped. In one of the main thoroughfares, where four roads meet, the water was fully four feet high, so that persons had to be taken across in carts, waggons, and cabs. In the lower part of the town the water flooded the lower rooms and cellars to a depth of several feet. John Riley, a boy, nine years of age, was drowned, being carried away in an open culvert.

BRADFORD.—At Bradford the storm raged tremendously, but, happily, produced no worse results than the damages such as usually attend rapid accumulations of water in public streets. Hailstones fell of extraordinary size, and glaziers will have plenty of work all over the town for days to come. Persons arriving from the North Riding report that the storm had been at the height of its fury there, and hailstones fell quite as large as boys' marbles. Houses and other buildings were struck by lightning, and chimneys and walls were knocked down in all directions. More than 1½ in. of rain fell in less than an hour.

SHEFFIELD, CROOKES.—A heavy storm, accompanied by exceedingly vivid flashes of lightning, broke over this neighbourhood yesterday afternoon, 18th. The parsonage house at Crookes, occupied by the Rev. C. G. Coombe, M.A., was struck by the lightning and very considerable damage was done. Mr. Coombe, with his wife and four children, were in the dining-room watching the lightning, when they were startled by a tremendous explosion, followed by a heavy fall of *debris* down the chimney. The lightning had struck the west stack, a portion of which had fallen on the lawn, some had gone through the roof, and the remainder down the chimney. Inside of the room the plaster of the chimney was cracked in several places, books were scattered in all directions, and the room presented a scene of the greatest confusion. The electric fluid appears to have passed between the flooring and ceiling into another room, forced up the hearthstone, and done considerable damage there. The occupants of the house were much alarmed, but they all escaped uninjured.—About the same time a cottage house at Crookes, belonging to Mr. John Spooner, was struck by lightning. Some damage was done to the cottage, and the furniture was knocked about a good deal, but no one was injured.

DONCASTER.—A heavy thunderstorm passed over Doncaster yesterday afternoon. The rain descended in torrents, and the thunder and lightning were fearful.

DRIFIELD.—On Monday last a fearful thunderstorm passed over this district. The lightning was very vivid, and the whirlwind so powerful as to blow down

trees and carry them 200 or 300 yards distance. Such was the case on the farm of Mr. Allanson Kendall, one tree being blown and driven over the adjoining field. About a mile distant, at the Wold House, Mr. R. Hornby's windows were broken and trees torn from the wall. At Kilham, a windmill was blown down, and cases of damage in different places in the district are reported.—A second and one of the longest and most terrible storms ever remembered, took place on Tuesday, continuing its fury for three hours, the thunder and lightning being incessant, and the downpour of rain enormous. On the Wolds the rainfall was so heavy that the water did great damage to the crops, and filled the cuttings on the Malton and Driffield Railway with muddy water quite level with the rails.

EASINGWOLD.—On Tuesday afternoon, a most terrific thunderstorm passed over this town and neighbourhood. During all the morning thunder could be heard at a distance, and about half-past two o'clock it began to be very loud, and the lightning was very vivid. The storm continued for about four hours, during which time the rain descended in torrents.

FIMBER.—One of the most destructive accompaniments of the storm occurred on the line of railway between Malton and Driffield. A survey on Thursday morning revealed the fact that a very deluge of water had fallen. For about a mile, commencing on the Malton side of Fimber, the railway was inundated with mud and gravel, left by the flood waters, and on the East side of the line the hills have six or eight abraded lines, several yards broad resembling the dried-up beds of rapid rivers. The soil thus brought down was deposited on the line in places quite a foot thick, and carried over the railway into the fields below, covering the crops.

HELMESLEY, &c.—On Tuesday, a fearful storm visited this district. The quantity of rain which fell was enormous, and at one part of the Thirsk line the trains ran through the water for nearly a mile. At Amotherby station the road had six inches of soft mud all over it. At Hovingham the crops were all under water, and the railway yard and some of the lower houses were flooded. At the saw-mills a great amount of damage was done, and some of the timber was carried away. From Hovingham to Gilling the land on either side was one great lake, and from Cawton to Gilling, about two miles, the water ran over the railway bank like a huge mill weir. A regular river was running through Gilling station, and the Helmsley trains could not depart from the proper platform. Access to Gilling could only be made in conveyances, and the whole town was under water, the cellars of the inn being flooded, and every room on the ground floor being more than a foot deep. The deplorable condition of the village from soft mud can hardly be imagined. At Ampleforth the water came off the hills so rapidly that it flooded some houses and ran out of the windows into the street. At this town the storm was a perfect deluge, and nothing like it can be remembered. Reports of stock drowned in the flood and killed by lightning are frequent. The view from the hill above Gilling down the Vale of Mowbray resembled the low part of Windermere. The loss to the farmers must be enormous.

KNARESBRO'.—A violent thunderstorm broke over the town and neighbourhood of Knarebro' on Tuesday afternoon. The dwelling-house of Mr. Benjamin Robinson, near the Oddfellows' Hall, in Knarebro' was struck by the electric fluid, and though some damage was occasioned to the building the inmates escaped unhurt, and the mischief is not serious. At Plompton, a cow was killed by the lightning, and several trees in the neighbourhood were also destroyed by the same terrible agency.

LEEDS.—On Monday, Leeds and neighbourhood was visited by a thunderstorm of almost unexampled violence. The lightning struck a chimney on the residence of Mr. Carter, dentist, 30, Park-square, but did no damage beyond filling the kitchen with soot and the house generally with smoke. A house in Marshall-street, Holbeck, and another in Fleece-lane, Meadow-lane, were struck, but in no instance has much damage been done, so far as can be ascertained. In some of the lower parts of the town cellars were flooded; but no great damage has been done. On Tuesday, there was another storm, but it was not so violent as Monday's. The river Wharfe was much swollen, and the lower part of Ilkley was four feet under water.

MALTON.—At Malton the lightning struck the gable end of Mrs. Arundel's tailors' shop, in Chapel-yard, knocked the brickwork and displaced a bay-window below, in which a man was sitting at work, who escaped unhurt.

HUTTON.—At Hutton, on Mr. Stilborn's farm, two horses were struck in different fields. One horse was in a cart, under which a young man had taken shelter from the rain. The horse bounded forward, and the young man escaped without injury. A number of sheep, the property of Mr. J. W. Cromet, of Milford Farm, were killed in the same way.

LOW MOWTHORPE.—A most terrific storm burst over the greater part of North and East Yorkshire, on the 17th. From every part accounts come in of damage to trees, crops, and stock, but the most serious case is that of a young gentleman who was struck dead at Low Mowthorpe. He was Mr. Robert Topham, son of one of the principal farmers of the Yorkshire Wold Valley, and was walking across a grass field towards the house, returning from ordering some women to get away, as a storm was coming, when he was struck down by the lightning and killed.

NEWHILL.—A dreadful thunderstorm, accompanied by rain and hail, burst over Newhill yesterday afternoon about three o'clock. A young man named Jas. Thorpe, a native of Wath, who was holding a horse in a cart, near the colliery at Newhill, was struck by lightning. He was holding a fork in one hand, and fell to the ground as if dead. He remained unconscious for a considerable time.

NORMANTON.—At Normanton Springs and Intake there was also a violent thunderstorm. The lightning was forked and very vivid, and accompanied by heavy showers of rain. No damage was heard of.

NUN-MONKTON.—The thunderstorm burst over the village of Nun-Monkton, on Monday, about noon, when the clouds gathered to the north-west of the village, and heavy peals of thunder followed, but the storm passed away to the northward. It had hardly, however, cleared away before a second storm was seen gathering, and this time, evidently coming directly towards the village. The clouds increased in density, and at half-past one in the afternoon the electric clouds had gathered so hugely and hung so low over the village that the darkness was quite appalling. Presently the lightning began to flash and the thunder to roll, moderately at first, but soon increasing in intensity, until flash followed flash in such rapid succession that it was hardly possible to discriminate between one and another, and the peals of thunder following created great alarm. The storm seemed to have reached its climax in about an hour, during which space it hung directly over the village, when there came a flash of extraordinary brilliance followed instantaneously by a terrific detonation, shaking the whole village. At this moment the house of a widow, named Wharton, was struck by the electric fluid, which tore away the coping of the western gable and made a large hole in the end of the house, entering an upper room and scattering the *debris* in every direction. The fluid then appears to have passed along the front of the building, which it again entered by a low window at the east end, driving in the glass of the window, and, striking a cupboard in a corner of the room scattered part of its contents on the floor. It then appears to have quitted the place, without leaving any evidence of the way in which it had escaped. After this fearful flash the storm gradually decreased in intensity and passed away to the eastward, but on its way the electric fluid killed three fat sheep, belonging to the Hon. Payan Dawney, which, with a large flock, were grazing in a field adjoining Beningbrough Park. The sheep which were killed were beneath an oak tree, which was only slightly injured. A recurrence of the storm took place on Tuesday afternoon, and continued with great violence from four o'clock until near seven, the rain falling in torrents, deluging the village and pastures, and causing the rivers Ouse and Nidd to rise upwards of a foot in about a couple of hours. During the storm the electric fluid killed a cow belonging to Mr. Greenwood, farmer, of Nun-Monkton, and one of the trees in Beningbrough Park was shattered and thrown across the road.

OVDEN.—A mill hand named Halliwell was killed at Halifax, when on his way to Ovenden; and at Ripponden, it is said, a boy was struck dead.

PIMBER HILL.—Six sheep the property of the Earl of Zetland were slain by the lightning in a field on Pimber Hill.

ROTHERHAM.—Yesterday afternoon, shortly after one o'clock, an alarming thunderstorm burst over Rotherham, and the surrounding villages. The peals of thunder were loud and oft-repeated, while the flashes of lightning were awfully vivid. This was continued throughout the afternoon and evening with more or less severity. Rain fell in torrents almost incessantly from one o'clock till a late hour last night. Several parts of the town were flooded, and in many instances dwelling-houses suffered very much from the effects of the flood. A house at The Holmes was struck by the lightning yesterday afternoon, and a young man who was in bed, was also struck and paralysed.

SELBY.—The violent thunderstorm which visited this county on Tuesday last was not very severely felt in Selby. For about an hour and a half the lightning was incessant, but not remarkably vivid, and the thunder continuous, but not heavy. The district around Selby was not so fortunate, for in nearly all the neighbouring villages the storm was very severe. At Riccall, a hay stack, the property of Mr. Bradley, was struck by the lightning, but did not sustain serious injury. During the storm a large stone was displaced from the Abbey Church, but as the lightning at no time appeared to be very near, it is difficult to believe it was occasioned by that agency. It may probably have been loose, and the vibration occasioned by the thunder have caused it to fall.

SHEFFIELD.—One of the most severe and serious thunderstorms which it has been our duty to chronicle for a long time occurred yesterday in Sheffield. The atmosphere during the early morning and throughout the forenoon was most sultry and oppressive. The sky was overcast, and the distant muttering of thunder could be heard at short intervals. It was not, however, until about half-past two or twenty minutes to three o'clock in the afternoon that the storm burst in its intensity over the town. The cloud was travelling in a northerly direction, and was very low and threatening. The peals of thunder were loud and prolonged, while the lightning was of a most brilliant and dazzling description. Large sheets of fire descended—they could not be called flashes—and lighted up the air with a strange, weird glare, and seemed to burst in some cases with a loud report. Higher up, streaks of the more dangerous forked lightning seemed to play a game of hide and seek with each other, and danced in and out of the cloud with bewildering rapidity. At half-past three the violence of the thunderstorm seemed to have abated. About four o'clock, however, it again began to thunder and lighten, and this state of things continued for some two hours and a half, rain falling most of the time. We regret to have to record some destruction of property in Sheffield, but fortunately, although several persons were placed in imminent danger, they escaped comparatively unhurt.

STANNINGLEY.—At Stanningley, a cow belonging to Mr. David Roberts was killed in the field, and at Calverley Moor a child was knocked down and stunned by the shock, but happily was not seriously injured.

TADCASTER.—A terrific gale passed over this neighbourhood on Tuesday afternoon. The thunder and lightning were very severe. We hear of several accidents having happened. In one instance two valuable beasts belonging to Mr. J. Stephenson, of Newton Kyme, were struck dead. Mr. F. Jackson, cabinet maker, of this town, was passing about ten yards distant at the time, but escaped unhurt.

THURGOLAND.—The storm raged for about one hour and a half. About 3 o'clock, the house of Mr. William Laycock was struck by lightning, which entered the chimney and pierced the ceiling. A clock was broken to pieces, and the house was filled with smoke and also the next house, but no personal injury was sustained. Rain descended in torrents. It was the heaviest storm for many years.

ULLESKELF.—A cow, the property of Mr. R. Powell, was killed by lightning.

WALKLEY.—About a quarter to three o'clock the lightning struck the chimney of a workshop at Walkley Bank-road, and in this case also some destruction to property was caused. The shop is in the occupation of Mrs. Wimpey, and in it the trade of file-cutting is carried on by her son and several other men. On the out-break of the storm work had to be suspended, and at the

time the bolt struck the stack three men were in the shop. The chimney was about five feet in height, and fully two feet of it has fallen. Passing down it the lightning blew out the bricks built round the stove, and appeared in blinding brilliancy on the floor, in shape like a ball of fire. A terrific explosion followed, and had it not been that the door and windows of the place, which is but of small size, were open, there is little doubt but that it would have been blown to pieces. The three workmen made their escape as quickly as possible, and on getting outside, one of them (Mr. Walter Wimpey) discovered that he was lame. On examining his right leg he found that the lightning must have touched him in some way, as on the "calf" there was a dull blue mark several inches in diameter. On venturing inside the workshop again, the men discovered that the fluid had completely destroyed, among other things, an old fashioned clock with brass chains, which hung over the fire-place. Several of the wheels were twisted out of all shape, and more than two-thirds of the chains were melted by the powerful heat.

RIVER WHARFE.—Great damage is done to the corn and grain crops adjoining this river, owing to the heavy rains having caused it to overflow its banks and wash the sand and rubbish among them.

YORK.—In this city and neighbourhood the thunderstorms of Monday and Tuesday last were of unusual severity, that on the last-mentioned day not having been equalled in duration and intensity by any storm for some years past. The lightning, sheet and forked, was of the most vivid description, and the peals of thunder rapidly succeeding each other, and increasing in power, accompanied by a long-continued heavy rain, rendered the storm of a terrific character. On Monday the thunderstorm lasted little short of an hour, but that of Tuesday continued for double that period. Considerable damage will doubtless have been done to many gardens and crops through the violence of the rain, which flooded the streets, and in some instances entered the cellars and lower rooms of houses, causing much inconvenience. Fortunately the damage to property in connection with the storms has not in this city been of nearly so extensive a character as in many other places. The only instance of which we have heard was the overthrow of an old stack of chimneys at the house of Mr. Dowson, butcher, Colliergate, in this city. At half-past four o'clock on Tuesday afternoon the lightning struck the chimney pots, shattering them to pieces, and overthrew the adjoining brick-work, which, falling heavily on to the roof, seriously damaged it. No other injury was, however, done. The greatest alarm at the time existed in the neighbourhood, a large quantity of the *debris* being precipitated into the street, in which fortunately at the time no one was passing. At the Barracks, Fulford-road, in the suburbs of this city, some considerable damage was done. A corrugated iron roof supported on pillars, leading from the officers' mess to the billiard-room, was thrown to the ground and broken, either through having been struck by the lightning or caught by the wind, which at the height of the storm was very violent. One of the barrack-room windows was also forced into the room, and one peculiarity of the storm noticed at the Barracks was its being accompanied, as at Newcastle and other places in the north, by a very strong whirlwind, the effect of which was that several wheelbarrows were lifted from the ground and whirled in the air for a considerable distance. This fact is vouched for by most reliable witnesses, who state that they had never except in India seen any more violent storm. As a consequence of the heavy torrent of rain the barrack yard was flooded over the greater part of its area, and presented the appearance of a lake. Fortunately no injury was sustained by any of the occupants of the barracks. The weather had been oppressively hot before the storm, the thermometer registering 82 degrees in the shade. After the storm the air was much cooler, the thermometer having fallen from eight to ten degrees. Occasional flashes of lightning were visible during the remainder of the evening. As a result of the heavy downpour of rain the Ouse and Foss were on the following morning considerably swollen; many large branches of trees were seen drifting with the stream, and adjacent low-lying lands were flooded.—A farm servant at Grimston, near this city, in the service of Miss Watkinson, whilst engaged milking in a shed, was struck by lightning and found in an insensible condition.

On assistance being rendered it was found that beyond being stunned and receiving a severe shock to his system he was not otherwise injured.—On Monday afternoon one of the garden walls of Captain Key, Fulford, was blown down. A chimney and part of the roof of a house situate in Cowper's Court, Skeldergate, were much injured by the lightning, and the inmates of the house, Mr. Dale, a groom, and his wife, were very much alarmed, but fortunately they were not injured. The rainfall during the continuance of the storms was unprecedentedly high at York. According to the register kept by Mr. F. P. Sigsworth, of Coney-street, no less a quantity than 0.60 in. fell in the course of half an hour on Monday, and on the following afternoon the enormous amount of 1.40 in. fell during the thunderstorm, making two inches altogether.

DURHAM.

WEST HENDON HOUSE, SUNDERLAND.—On the 17th we had a little thunder, but on the 18th, the greatest thunderstorm I ever saw in this country. The different portions of the storm moved from S.W. to N.E. The thunder was heard about 1 p.m. and it continued to be frequent till 6.10 p.m.; it was almost incessant from 1.45 to 3.15 p.m., and quite so for about half-an-hour at the height of the storm. The lightning was frequent from 2 to 6 p.m. most of it being forked. The storm was at its height about 2.20 p.m., about which time there was furious rain, mixed with hail; .50 in. fell from 1.45 to 2.45 p.m., nearly all of it falling in a few minutes. I counted twenty flashes in three minutes, and at another time thirty in five and a half minutes, but when two or three occurred at or near the same moment, I called them but one. I saw four within a second at one time, far apart. The spectrum of the brightest flashes consisted of bright lines, apparently those of the ordinary spectrum of air. In the afternoon and evening the fluctuations of the barometer were very numerous, but small. The ther. fell to 56° about 6 p.m., rising with a strong breeze to 67°·0 about 10.45, and reaching a min. of 54° in the night.—*T. W. Backhouse.*

BISHOP AUCKLAND.—At Bishop Auckland the storm caused extensive damage to property. Shortly after one o'clock in the afternoon, the sky became overcast, and rain commenced to fall. Thunder and lightning followed, peal after peal and flash after flash, in rapid succession, for upwards of an hour, when a terrific crash took place immediately over the town, which appeared to shake every building. Several houses were struck and more or less damaged. A house in Clyde-terrace was struck, and the roof and ceiling were considerably damaged. The chimney of the house of Mr. Lindsay, Board of Health Surveyor, in Silver-street, was struck by the electric fluid. The rain which fell in torrents during the whole of the time, has done an amount of damage which cannot at present be estimated; and it is said that never was such a deluge known in Bishop Auckland before. The lower part of the town, as a matter of course, suffered the most. All the streets with the least incline emptied themselves into those lower, and Princes-street was like a large river, as were also High and Fore Bondgate, Tenters-street, and the Chares. The Market Place was like a small sea. The shop of Mr. Briggs, at the corner of Tenters and Newgate-streets, was flooded a foot deep, while in the kitchen the child's cradle and other furniture were floating about the floor. Serious damage was done to the wardrobes of Mr. Buttlar's company at the Theatre. The dressing rooms are under the stage, and through the main sewer in Newgate-street being unequal to the flood, the water appears to have flowed back up the drain, and completely flooded the dressing room to a depth of nearly five feet. The baskets containing the wardrobes floated about, and no one dared enter. Consequently all the property was completely saturated. The cellar of Mr. Boyd's Hotel stood nearly five feet deep with water from the same cause, and even large barrels of beer and spirit and cases of champagne were floated about, and damage to a large amount done. Numerous other cellars were flooded, and great damage done to property.

(*To be continued.*)

EVAPORATION.

To the Editor of the Meteorological Magazine.

SIR,—In your review on Dr. Buijs Ballot's "Suggestions on a Uniform System of Meteorological Observations," I observe in the June number of the Magazine this remark—"He, however, has evidently come to the same conclusion as ourselves respecting the uselessness of the evaporators hitherto used." Now, are we to look upon this assertion as anticipating the long-expected report on the experiments made at Strathfield Turgiss, and are the observers of this country forthwith to abandon their present evaporators?

On reading the "Suggestions," I noted what Dr. Ballot states, under the head of "Atmometer;" he says:—"Unless more minute observations be taken, we shall certainly get but a faint notion of what is restored to the atmosphere. The amount now seems larger than what is received. Yet, on the whole, this is positively inconsistent with the fact. What would become of the rivers of England if more was evaporated than what falls? It may be right in lower regions, where in general less rain falls, yet even here it will not be taken for granted."

I wrote to him on this subject, and pointed out that my own observations, given in the *British Rainfall*, show a different result—that I make the evaporation much less than the rainfall—though my observations are made in a low country, and in the region of least rain (in England). At present I am engaged experimenting on a method for determining the evaporation from different soils, and from grass, and I hope to make my *Evaporometer* self-registering; but as my method is not fully developed, I must reserve details for a future time. I should be glad to see evaporation receive from meteorologists the attention it deserves, for if we can arrive at a reliable method of estimating it, will it not be an important element in solving the great problem of solar energy, as well as in determining the amount of water to be carried from the land by rivers and drains?

Yours very truly,

SAMUEL H. MILLER.

Wisbech, 28th June, 1872.

[We are surprised that Mr. Miller should have been led into error by the sentence which he quotes from our June number. In writing it we assumed that our readers remembered our remarks upon the subject in previous publications, in the last of which (*British Rainfall*, 1871,) it is stated that the subject of evaporation "has almost entirely passed out of my hands and into those of Mr. Rogers Field," wherefore we should certainly not indicate his final results in so casual a manner as by less than two lines in a review. Our remark is based upon the experiments quoted in *British Rainfall*, 1869, p. 155, which, to the best of our belief, have been corroborated by every subsequent enquiry. Mr. Miller seems to think that in condemning the evaporators hitherto used we are condemning his: not at all. His are experimental ones, not ordinary instruments, and we are all much indebted to him for his services

in this difficult matter, but as some of his evaporators lose twice as much as others, it is clear that he himself will ere long have to condemn some of them; as for the instruments sold by opticians as evaporation gauges, the sooner they are sold for old metal the better.—ED.]

RAINFALL REGISTERED BY GAUGES INCLINED AT 45° , AT THE ELEVATION OF 6 AND 30 FEET.

To the Editor of the Meteorological Magazine.

SIR,—In *British Rainfall*, 1871, page 56, you call the especial attention of your readers to the following observed facts, that two gauges, inclined at an angle of 45° , at the elevations of 6 and 30 ft., give *equal* amounts of rainfall, though the horizontal gauges at 6 and 25 feet, show the normal differences. I suggest that the true explanation of this apparent departure from the law of decrease with elevation, is as follows:—Referring to *British Rainfall*, 1871, page 28, Table II., compiled by the Rev. F. Stow, we find that the average angle of rain with the vertical at 5 or 6 feet is about 58° , at 10 feet about 61° , so I think we may assume the angle at 30 feet to be not less than 70° . Now, though the increasing angle of rain causes no difference in the amounts registered by horizontal gauges, it is far otherwise with inclined gauges. By a deduction from Table II. we find that the returns of a gauge inclined at right angles to the rain falling at an angle of 70° , will exceed those of a similarly placed gauge with the rain at an angle of 58° , in the ratio of 152 to 100 (*see rainfall for March and April*, in Table II., when the angles of rainfall are about 70° and 58° respectively); if these two gauges are tilted up to only 45° , then the ratio will not be nearly so disproportionate; yet the gauge at 30 feet elevation, where rain is falling at an angle of 70° , will register an amount considerably in excess of that at 6 feet, where rain is falling at 58° . Now let us refer to the results observed by Mr. Arnold (*British Rainfall*, 1871, page 52), the gauge inclined at 45° at the elevation of 30 feet, registers very nearly the same amount as that at 6 feet; why does not the usual decrease of rainfall with elevation show itself? I think we may safely infer that there is a counteracting cause of increase, which nullifies the former, viz. (as stated above), the larger proportion of rain caught by the higher gauge in consequence of the rain falling at a larger angle with the vertical. It is very remarkable that the observations made by Mr. Arnold with gauges inclined at 45° , show that the loss of rainfall, which is presumably caused by increase of height from the ground, is exactly balanced by the gain arising from the increased angle of rain; I think it would be very satisfactory to compare the results of further experiments with gauges inclined at 45° , at various elevations, with a view to throw further light on this subject. Trusting that I have not occupied too much space in your Magazine,

I am, Sir, yours truly,

G. WARREN.

Merton Villa, Cambridge, June 21st, 1872.

JUNE, 1872.

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 ≥ 0.1 or more fell.	Max.		Min.						
				Inches.	Dpth.		Date.	Deg.	Date.	Deg.	Date.				
												In shade	On grass.		
I.	Camden Town	2.55	— .50	.58	24	15	85.9	17	40.6	7	0	0			
II.	Maidstone (Linton Park)	4.13	+ 1.39	1.71	24	17	91.0	18	36.0	1, 3	0	...			
III.	Selborne (The Wakes)	3.68	+ .45	.80	8	17	80.2	17	33.5	7	0	1			
IV.	Hitchin	2.47	— .17	.39	11	18	80.0	16+	39.0	6	0	...			
V.	Banbury	2.76	— .52	.46	9	15	86.5	18	35.0	7	0	...			
VI.	Bury St. Edmunds (Culford)	2.01	— .57	.23	27	17	84.0	17	35.0	4	0	1			
VII.	Bridport	4.12	+ .88	.94	18	18	79.0	17	36.0	1	0	...			
VIII.	Barnstaple	5.32	+ 1.20	2.50	18	19	74.5	25	41.0	1	...	...	
IX.	Bodmin	3.20	— .84	.63	7	17	73.0	18	42.0	1	0	0			
X.	Cirencester	3.45	+ .07	.36	8*	18	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall)	4.72	+ 1.61	1.51	24	16	81.0	18	37.0	7	0	...			
XII.	Tenbury (Orleton)	5.29	+ 1.77	.76	19	20	83.2	18	34.7	7	0	1			
XIII.	Leicester (Wigston)	4.68	+ 1.92	1.12	18	17	91.0	18	36.0	6	0	...			
XIV.	Boston	2.00	— .19	.42	8	17	83.6	18	40.0	1	0	0			
XV.	Grimsby (Killingholme)	2.17	...	.49	25	16	77.0	18	41.0	1	0	...	
XVI.	Derby	5.27	+ 2.38	1.06	25	18	84.0	18	37.0	7	0	...			
XVII.	Manchester	6.90	+ 3.56	...	...	24	...	...	...	...	...	...
XVIII.	York	5.84	+ 3.74	1.31	18	18	83.0	19	39.0	1	0	...			
XIX.	Skipton (Arnccliffe)	6.05	+ 1.95	.63	24	23	...	...	...	...	...	...
XX.	North Shields	2.95	+ .21	.75	18	19	71.0	16	39.8	1	0	0			
XXI.	Borrowdale (Seathwaite)	12.30	+ 1.79	1.67	27	18	...	...	...	...	...	...
XXII.	Cardiff (Ely)	3.96	— .68	.76	20	14	...	...	...	...	...	...
XXIII.	Haverfordwest	5.38	+ 1.73	.78	19	15	76.2	17	39.5	29	0	...			
XXIV.	Rhayader (Cefnfaes)	5.72	+ 1.74	1.20	18	20	76.0	...	35.0	...	0	...			
XXV.	Llandudno	5.20	+ 2.91	1.55	9	22	78.7	18	39.8	7	0	...			
XXVI.	Dumfries	5.60	+ 2.70	.74	8	21	79.5	18	37.5	7	0	0			
XXVII.	Hawick (Silverbut Hall)	2.78	...	.62	6	18	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House)	5.39	+ 2.04	.93	24	22	75.0	18	37.0	7	0	0			
XXIX.	Castle Toward	8.67	+ 5.18	1.05	28	24	68.0	18	...	...	...	...
XXX.	Leven (Nookton)	3.63	+ 1.39	.51	27	23	72.0	18+	39.0	1	0	2			
XXXI.	Stirling (Deanston)	6.88	+ 3.96	.68	19	25	76.7	18	36.0	1	0	1			
XXXII.	Logierait	5.20	...	.68	7	23	76.0	18	35.0	8	0	...	
XXXIII.	Ballater	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Aberdeen	3.84	...	.57	7	22	69.5	18	41.0	1	0	2	
XXXV.	Inverness (Culloden)	4.94	...	1.48	8	17	67.7	19	43.8	1	0	0			
XXXVI.	Portree	4.80	+ .02	.67	7	28	...	...	...	...	...	...
XXXVII.	Loch Broom	5.66	...	1.25	8	23	...	...	...	...	...	...
XXXVIII.	Helmsdale	4.81	...	1.24	7	25	...	...	...	...	...	...
XXXIX.	Sandwick	3.52	+ 1.98	.86	28	18	67.5	18	42.8	1	0	1			
XL.	Cork	3.52	...	.51	7	18	...	...	...	...	...	...
XLI.	Waterford	3.20	+ .22	.52	30	21	70.0	19+	40.0	10	0	...			
XLII.	Killaloe	4.73	+ 1.10	.86	1	24	76.0	17	37.0	6	0	0			
XLIII.	Portarlington	3.21	— .04	.59	15	26	71.0	18	38.5	1	0	...			
XLIV.	Monkstown	2.60	— .02	.52	1	19	78.5	18	34.0	8	0	...			
XLV.	Galway	6.09	...	.87	21	27	68.0	17	40.0	7, 9	0	...	
XLVI.	Bunninadden (Doo Castle)	...	...	...	...	...	...	...	...	...	...	...
XLVII.	Bawnboy (Owendoon)	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	3.08	...	.46	8	22	78.0	17	41.0	6, 7	0	0	
XLIX.	Strabane (Leckpatrick)	5.41	...	.66	1	27	...	...	...	...	...	...

* And 9, 11. † And 17. ‡ And 20. § And 28, 29. ¶ And 18.

+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.

LINTON PARK.—Except a few days in the middle, the month has been dull, wet, and often cold for June. Thunder frequent, but not often near, excepting on 24th, when we had the most severe thunderstorm I have on record, the thunder continuing for four or five hours in the afternoon, and at 5 p.m. .50 in. fell in a few minutes; at 7 p.m. the storm was repeated with greater force, 1.20 in. falling in little more than 30 minutes, the thunder and lightning continuing the whole time; we had no hail, though some of our neighbours only a short distance off had hail of an unusual size, and doing much damage. Bar. unsteady, wheat not fairly in ear until the 18th, being four or five days later than usual.

SELBORNE.—Almost oppressively hot from 15th to 19th inclusive, the mean max. being 73 deg. for the five days. We have had distant rolling thunder repeatedly, but no thunderstorm this month; frost on the grass on the 7th; rain, hail, and thunder on same date.

HITCHIN.—Heavy thunderstorm coming up from S.W. on 19th; 1 inch of rain fell within three-quarters of a mile of this house, but we had only .04.

BANBURY.—Thunderstorm on 7th, 19th at 10.30 a.m., and 23rd, but no heavy rain.

CULFORD.—Mean temp. of month 59°.2; westerly winds on 24 days, and easterly on six. Thunder on 3rd, 10th, 18th, 19th, 24th and 26th.

BRIDPORT.—A very wet month; temp. high from 16th to 26th; lightning on the morning of the 18th, and on the morning of the 19th there was a heavy thunderstorm from 7.15 to 10.45 a.m., when 1.10 in. fell in three-and-a-half hours; heavy gale on the 8th.

BODMIN.—Average bar. 29.94; average temp. 58°.9.

CIRENCESTER.—Very cold and wet till about 13th, when warm weather set in, and continued with slight intermissions to the close.

SHIFFNAL.—The early part of the month wet and cold, up to the 12th the ther. only once reached 65 deg. (on 4th), but a sudden change took place on the 13th, when it rose from 62 deg to 70 deg., and the high temp. kept up till the 22nd; oppressively hot from 14th to 19th inclusive, 81 deg. on 18th; distant thunder on 18th; severe thunderstorm on 19th, at 10.30 a.m., but on 24th such a thunderstorm as cannot be remembered, with a deluge of rain, nearly 1.50 in. falling between 3 and 4.15 p.m. The wind varied from N.W. to S.W. throughout the month. Foxglove and dog rose in flower on 14th; blue butterfly first seen on 15th, painted lady butterfly first seen on 20th.

ORLETON.—Very cold, cloudy, and stormy, till the 12th, with rain every day, then five fine days, followed by great thunderstorms on the 18th and 19th. Another great thunderstorm occurred on 24th. Thunder heard 7th, 18th, 19th, 24th, 25th, 26th, and 28th. Rough winds frequent. Mean temp. rather more than half a degree below the average. Frost on the 7th.

WIGSTON.—Temp. since the 12th much above the average for this month, and both grass and corn have been much improved. Rainfall greatly in excess of average, and I have no record for 36 years of so large an amount of rain falling in the *first six months* as during the past six months, the total quantity being 17 in.

BOSTON.—Thunderstorms on 6th, 7th, 10th, 17th, 18th, and 24th.

GRIMSBY.—The ground full of slugs and wireworms, and garden crops suffering in consequence; grass abundant, but rain wanted at the end of the month for the root crops. Thunderstorm on 3rd at 10.30 a.m. A man killed at Ottringham, Yorkshire. Thunderstorm, with hail and rain at noon on 10th. Thunderstorm on evening of 24th. Thunder, evening of 7th and 25th. Lightning on 17th. Distant thunder in N. on 18th. Wheat coming into ear on 20th.

DERBY.—Rain of month nearly double the average; temp. about 4 deg. above the average. Violent thunder on 18th, 19th, 24th and 25th. Low lying lands frequently inundated; the great crop of grass injured and spoiled; pasture cannot be kept down by the stock. This kind of weather has provoked the growth of shrubs and trees in a marvellous degree.

ARNcliffe.—The whole month unusually cold and cheerless, with much thunder.

N. SHIELDS.—Terrible thunderstorm on 18th. Solar halo on 5th.

W A L E S.

Haverfordwest.—During the last 23 years there has only been one June exceeding this in wetness, and that was in 1860, when 6·70 in. fell; the temp. has been below the average. Early on the morning of 19th there was a heavy thunderstorm, lasting rather more than an hour; 60 in. fell during the storm. Several sheep and one or two young horses were killed a few miles from this place during the storm. Ther. only exceeded 70 deg. on four days, and reached it on five. Heavy hay crops; corn looking bad, and very backward in blooming.

CEFNFAES.—The month has been cold and wet; warm summer weather from 14th to 20th. Violent thunderstorm on night of 18th and morning of 19th. Heavy rains, doing some damage by sudden overflowing of small brooks. Sheep and cattle killed.

LLANDUDNO.—The whole month has been wet and uncomfortable, with the exception of three or four days, which were brilliantly bright and warm; frequent thunder.

S C O T L A N D.

DUMFRIES.—This has been the wettest month of June on record for upwards of 22 years, there having been only 9 days on which no rain has fallen. Thunder on 9th, 18th and 19th. On 19th so dark at noon that gas had to be lighted. The rainfall is greatly in excess of the average, temp. 1·75 lower than corresponding month of last year; although the rainfall has been so excessive (this district having a dry soil) the excess has not been prejudicial except for haymaking, crops of all kind are very luxuriant and the fruit crop promises to be abundant.

SILVERBUT HALL, HAWICK.—A cold wet windy month. Magnificent crops of hay.

AUCHENDRANE.—The monthly mean ther., bar. pressure, elastic force of vapour, and evaporation are all below the June mean, while the bar. range, rainfall, force of wind, and amount of cloud are all more or less above it. We have had no thunderstorms, which have been so severe in other districts, rivers full all the month, crops looking well, hay crop heavy, foliage of trees particularly large and fine. Lightning in S. on 18th in evening.

CASTLE TOWARD.—The rainfall this month has been very large, scarcely any day without rain, and but little sunshine. Potatoes and other crops look very healthy, and grass abundant. Dense fog on 17th, flood on 28th, and on the whole a bad month for all out-door occupations.

NOOKTON.—Thunder between 7.30 and 8 p.m. on 18th.

DEANSTON.—The whole month very cold and wet, rain 6·88 inches, being nearly 4 in. above the average, and more than in any month of June since 1838, when there was 7·80. On 8th and 9th thunderstorm with rain and hail, distant thunder on 10th, 11th, and 20th. Crops generally looking well, but fruit more deficient than was expected.

LOGIERAIT.—Only 7 days on which no rain was measured, a very unusual occurrence. Vegetation well advanced, hay crop remarkably heavy, thunder on 8th and 18th.

ABERDEEN.—A dull wet month, with unusual frequency of fogs, but rather mild. Turnip sowing very much hindered, other crops looking much better than might have been expected, but rather late; the rainfall since the 1st of January, 8 in. above the average; for at least 40 years the same months have never been so wet.

PORTREE.—A very wet and cold month; the coldest June on record. A strong gale from S. from 4 a.m. to 1 p.m. on 22nd. The cold has retarded all our crops, which will give us a late harvest.

LOCHBROOM.—This has been a wet and cold month. Turnip sowing, sheep shearing and other agricultural occupations kept back, but though the weather has been cold as well as wet, yet the grazing is most abundant, stock in capital condition, the clip of wool is said never to have been better, and the price seems to correspond.

SANDWICK.—This has been the wettest June during the 32 years of observation, the temperature has also been high, so that vegetation has been rapid; many peals of distant thunder from 7.30 to 8.30 p.m. on 18th.

I R E L A N D.

MONKSTOWN.—Beginning and end of month wet; about the third week we had some fine warm weather; highest daily mean, 63°·6 on 19th; thunderstorm on 8th.

WARINGTOWN.—Rain fell on 22 days, and the weather (with the exception of a few days in the middle) was cold, yet notwithstanding this want of heat the crops are, generally speaking, fine here.

LECKPATRICK.—Rainfall more than double the average of past ten years; the wettest June during that period except in 1863, when it was 5·87 in.

ART AND METEOROLOGY.

To the Editor of the Meteorological Magazine.

SIR,—I wish to note, for consideration at some future time, the fact that on the evening of Sunday, the 23rd of June, the atmosphere of London and its neighbourhood was so serene and clear, that from Primrose Hill I was enabled to see the following landmarks:—the Crystal Palace and its Water Towers, Knockholt Beeches, more than 20 miles distant, on the North Downs, and Shooters' Hill, to the south of the Thames, Harrow, Hampstead and Highgate Churches to the north and north-west of the Hill. The wind blew gently from the S.E.; it was a splendid evening, St. Paul's, and every building in London, within view, was as distinct as if they had been painted on canvas by the most scrupulous pre-Raphaelite.

In the western sky there were some persistent *cirri*, forming strange groups, which lasted for more than an hour. The *cirri* bristled (electrically?) in one fish-like form, so as to represent the fins and tail.

The next day there was a heavy thunderstorm, which was severely felt in London and elsewhere.

Could not the artist's pencil be added to our list of meteorological instruments? I have often thought that from such points as Hampstead or Primrose Hill, were an artist to sketch the western and the eastern skies, at a definite time before and after the setting and rising of the sun, for a whole twelvemonth, and the weather noted, much really practical information might be accumulated and easily taught. What impossible skies we see every year in the Academy! simply, I suppose, because "Nature puts the artists out," as she did Fuzeli, according to his own confession to Haydon.

Let anyone, however, work, crayon in hand, from any selected spot for a twelvemonth together, and carefully note the weather of the locality, I feel confident that he would never regret the fulfilment of his task, and science would be greatly indebted to him. Such a series of pictures, if carefully executed, would be enough to establish a young artist's name, and eventually lead him on to fame.—I am, Sir, obediently yours,

ALFRED HAVILAND.

Hampstead, July 9th, 1872.

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METEOROLOGICAL MAGAZINE.

LXXIX.]

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THE THUNDERSTORMS OF JUNE 17TH, 18TH, AND 19TH.

It was originally our intention to have thoroughly discussed *all* the thunderstorms of the present summer, but they have been so unprecedentedly numerous, that the materials already in our hands would fill at least a hundred pages of this magazine; it is therefore impossible to carry out our first intention, and consequently we shall confine our remarks to the storms of the three days mentioned above.

In the first place, we have the pleasure of supplementing our previous notes with the following, which (as will hereafter be seen) have been very useful in defining the storm areas.

MIDDLESEX.

CAMDEN SQUARE.—17th. Distant T at 4.46 and 4.55 p.m. 18th. Distant TS in S.W. between 5 and 6 p.m., afterwards very fine. 19th. Fine morning, but stormlike after 11 a.m.—*G. J. Symons*.

SURREY.

FOREST HILL.—17th. No T. 18th. Distant T in N.W. from 5.2 to 5.27 p.m. 19th. Very distant T occasionally from 4.30 to 5 p.m.—*E. E. Glyde*.

HALFORD HOUSE, RICHMOND.—17th. No T. 18th. Loud claps of T about 4 p.m. 19th. No T. No rain between 17th and 21st.—*E. Mawley*.

NORTHBOURN, CHOBHAM.—No storm between 16th and 21st.—*J. M. Ward*.

SUSSEX.

BUCKINGHAM PLACE, BRIGHTON.—No electrical phenomena recorded on 17th, 18th, or 19th.—*F. E. Sawyer*.

HERTS.

HARPENDEN, ST. ALBANS.—17th. Distant L in N. about 9 p.m. 18th. T and L in S. and S.W., 4 to 6 p.m., T at times incessant, heavy storm in that direction. (This was the Watford storm.) 19th. T at 11 a.m., shower about noon.—*F. W. Stow*.

BUCKS.

NEWPORT PAGNELL. — No storm between 16th and 21st.—*R. Littleboy*.
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OXFORD.

BROUGHTON, BANBURY.—17th. T in S. from 6.15 to 9 p.m. 18th. T in S.W., W., and N., from 0.10 to 5 p.m. 19th. TS passing from S.W. to N.E. at 10 a.m., and another from W. to E. between 11 and 11.45 a.m.—*E. C. Morrell.*

BEDFORD.

SANDY.—17th. T & L. 18th. T. 19th. Heavy TS & R.—*A. McFarlane.*

ESSEX.

AUDLEY END.—19th. TS at 3.15 p.m., and another from 8.30 to 9.30 p.m.—*J. Bryan.*

SUFFOLK.

SUDBURY.—No storm, except a slight one on 19th from S.W. at 4 p.m.—*J. Alexander.*

IPSWICH, BISHOP'S HILL.—19th. TS and heavy R between 6 and 7 p.m.—*G. A. Biddell.*

WILTS.

LUDGERSHALL.—No storm except at 8.15 a.m. on 19th.—*E. G. Fawcett.*

DEVON.

DARTMOOR PRISON.—18th. TS from 7.30 p.m., to 4.30 a.m. on 19th.—*H. Watts.*

ASHBURTON.—18th. Heavy TS from 8 p.m.

CORNWALL.

POUGHILL VICARAGE.—18th. Severe TS.

GLOUCESTER.

CLIFTON.—17th. No storm, thunder clouds about 5 p.m. 18th. No storm, but sudden development of thunder clouds about 3 p.m., and three or four peals of T without R. In evening, appearance of distant TS in W. and N.W. 19th. TS from 9 to 10 a.m., RR from 8.30 a.m. to noon.—*G. F. Burder.*

SHROPSHIRE.

SANSAW, SHREWSBURY.—18th. T. 19th. T.—*F. Gartside Tippinge.*

WARWICK.

BICKENHILL.—18th. 1.45 p.m., T; hygrometer bulbs 5° apart; incessant roaring of T; upper current of cloud S., lower current due W. Swallows flying about 20 ft. from the ground. 2.30., T still roaring, L very vivid. 3.50, T still continuing at a distance. 4.10, thundering still; rainfall .82; wind veered to S.W.; dry 72°, wet 70°. 19th, wind S. by E. 10.50 a.m., T distant, but approaching; L and T from S.W., wind veering to S.S.W.; very heavy R; vivid L from W.; hail-stones; lightning from S.E. 11.10; storm receding towards E., ceased at 11.10; rainfall, .99.—*W. R. Capel.*

LANCASHIRE.

HURST BANK, BOLTON.—17th. No T. 18th. Distant T, 2 to 9 p.m. 19th. Distant T.—*J. Watkins.*

STONYHURST.—17th. T. 18th. Heavy TS; 19th. T and 0.77 in. of R.—*S. J. Perry.*

YORKSHIRE.

THICKET PRIORY.—17th. Heavy TS, passing from N.W. to S., between 2.50 and 3.15 p.m.; total R, 0.50 in. in 25 minutes. 18th. Very violent TS passed from S. to N. between 5 and 7 p.m.; 1.20 in. of R fell in the two hours; a man killed under an oak in the neighbouring village of Riccall. 19th. Slight TS and T most of the day.—*M. C. Dunnington-Jefferson.*

SKIPTON, BUCKDEN.—17th. T. 18th. Much T.—*W. R. Metcalfe.*

DURHAM.

GAINFORD.—17th. T. 18th. Distant T from 11 a.m., heavy TS at 1 p.m.—*A. Atkinson.*

USHAW.—On the 18th of June thunder began to be heard to the S.W., shortly before 1.0 p.m., and continued until about 5.30. At one period or another the storm appeared on every side, but the lightning was never very near, the shortest distance seeming to be from two to three miles. With the exception of a brisk south wind at 1.30, somewhat of the character of a whirlwind, and which lasted only for a few minutes, the air was very still. The sky was completely overcast and dark, being covered almost uniformly with clouds of a deep slate colour. Gentle rain fell almost incessantly, but so lightly, that during the whole time of four-hours-and-a-half, the rainfall was only 0.07 in. The atmosphere being free from haze, the distant lightning presented a magnificent spectacle, for the flashes succeeded each other with great rapidity, and consisted often of several shafts of forked lightning striking the earth at the same instant. Not unfrequently a succession of four, five or more distinct discharges followed each other in the same path, but so rapidly as to appear like a continuous stream of the electric fluid emitting a twinkling light of dazzling lustre. All this gave evidence of a state of electric disturbance of extraordinary activity—a fact which was soon confirmed by reports of mischief done to life and property at various points of the surrounding neighbourhood.—*J. Gillow, D.D.*

GATESHEAD FELL.—With unexampled violence the storm yesterday broke over this neighbourhood. To say that torrents of rain fell describes the downpour in the mildest of terms. At twenty minutes to two o'clock a tremendous crash occurred near the Low Fell National School. The electric fluid struck and demolished the chimney of a house on the opposite side of the lane to the school, occupied by two tenants, Mrs. Trotter and Mr. Firbank, and after a most erratic course through, and damaging more or less every one of the six rooms in the building, finally made its escape again through the roof, smashing a large hole three or four feet square, and throwing the slates and debris to a distance of quite twenty yards.

GATESHEAD.—The frightful thunderstorm which swept over this neighbourhood yesterday afternoon, damaged property to a considerable extent in Gateshead, but, fortunately, so far as we were able to learn, was not attended with any fatal results, although two or three persons had very narrow escapes with their lives. The lightning which preceded each awful brattle of thunder, was terribly vivid, and the rain, hail, and pieces of ice descended in a downpour perfectly unprecedented in the opinions of the oldest inhabitants. The best portion of Gateshead is built on a steep descent, and as soon as the flood set in, it ran with great rapidity and power down all the principal thoroughfares to Pipewellgate and other streets adjoining the river Tyne. From the

Windmill Hills, the water ran down Mulgrave-terrace like a perfect sea, as it did also down West-street, and the two streams joining each other underneath the railway arch, proceeded in one vast body down the Half Moon-lane, and on into High-street, where it mingled with another equally as powerful as the first two put together. As the immense rush of water ran down the Bottle-bank—one of the most steep descents in the borough—the sight was most appalling. At the foot of the bank the flood turned sharply round into Pipewellgate, and the damage done in this densely-populated and poor neighbourhood was beyond comprehension. In all the thoroughfares mentioned above, when the storm was at its height—shortly before two o'clock—the flags and paving were completely hidden from view, and it is estimated that there could not have been less depth than two feet of water on the streets. Such was the force with which the flood rushed on its course, that whenever it came against a lamp-post the spray leaped up right into the air. Hand-barrows left standing by the side of the flags were swept over and over again like straws. Huge stones were hurled along as if they were pieces of coke, flags were driven from their seats, paving stones were shifted, and wherever the stream came in contact with a horse the spray was sent right over its head. Carts standing about delivering perishable goods were soon filled with water, and in this way a considerable amount of damage was done. Notwithstanding that every precaution was taken by those occupying houses and shops in Mulgrave-terrace, West-street, High-street, and the lower part of the town, the water could not be stemmed back, and made its way into those premises with great force, and emptying itself into the cellars beneath, there were few tradesmen but what suffered considerable loss. In Pipewellgate the poor shopkeepers lost a vast amount of goods. The butter and candle shop of Mrs. Henderson suffered most damage, and in addition to the best portion of the stock being rendered totally unfit for sale, the force of the water broke nearly the whole of the glass front in, and having gained an entrance in this way, the premises became filled to a depth of between three and four feet. Two stones of bread were swept away into the Tyne, and the loose fixtures were quickly swimming about. A woman who had entered the shop for shelter was hemmed in, and had a narrow escape from drowning, but fortunately some men hearing her cries for assistance broke through the staircase and rescued her from her perilous position. The kitchen in the establishment of Mr. C. Ester, Brandling Junction Inn, at Redheugh, at the extreme west end of Pipewellgate, was flooded to a height of 5 ft. 2 in. An ash-pit at the head of the Bankwell-stairs was struck by the electric fluid, and shivered into pieces. At the corner of the Bottle-bank and Bridge-street, the stream divided itself into two courses, and filled all the cellars right away down both thoroughfares—that underneath Lambton's Bank, where the bullion is kept, being well filled amongst the rest. Two little children, between three and four years of age, whose parents reside in the immediate neighbourhood, were walking up Mulgrave-terrace when the flood was at its height, when the force of the water caught them and they were rolled down the street with great rapidity until approaching the tunnel, in which they must undoubtedly have been drowned, when a gentleman courageously and heedless of the great danger he ran in doing so, rushed into the stream and picked the youngsters up. One gentleman curious in such matters, picked up one of the hailstones which so freely came along with the rain, and weighing it found it to be half-an-ounce in weight. The damage done in the borough by lightning, although startling enough, did not amount to anything extraordinarily serious. In Forster-street, the fluid struck the gable of an occupied house, but beyond making a large rent in the wall, there was no other damage, the occupants being unhurt. Dr. Ridley's house, on the Windmill-hills, was also slightly struck, and for a short while Mrs. Ridley suffered severely from the effects of the shock. One of the servant girls in the same house was also slightly scorched about the face. The lightning gained admittance into Mr. B. J. Prockter's house, on the Windmill-hills, by means of the chimney, and, descending into the room below, broke a large mirror, as well as a handsome wardrobe. Mr. Prockter and those in the house, however, escaped uninjured.

SHIELDS.—North and South Shields and locality were, on Tuesday, 18th, visited by a terrible thunderstorm, accompanied by a deluge of rain and hail. Shops and houses in low parts of the town were flooded, considerable damage being done. John Purvis, pilot, while standing at Lawe, South Shields, was struck by lightning, rendered insensible, and severely injured. Lightning also struck a large stone beacon facing the sea at South Shields, and almost destroyed it. A wall in Thames-street, South Shields, was knocked down and fell on the roof of a dwelling-house, breaking it in, and the inmates had a narrow escape. The fishing smack, Ten Brothers, belonging to Eyemouth, returned to North Shields in the evening. While at sea, in the afternoon, engaged in the herring fishery, she was overtaken by the storm, and while the crew were preparing to run to Shields harbour, the anchor and chain were struck by the electric fluid, which passed through the hold, and then ran up the mast, which it shattered to pieces. The lightning struck and killed the captain, and one of the crew, named Leston Rutherford, was so severely injured that he is not expected to recover. The lightning also destroyed the flagstaff at Tynemouth Castle, carried away two chimney-pots belonging to the residence of Canon Bewick, at Tynemouth, and struck several iron steamers and ships in the river, but it did not do any serious damage in that respect.

JARROW.—The old pit cottages in High-street, Dogbank-row, and other localities, were completely inundated with the water, and no small amount of damage was done to the furniture of the poor people—principally Irish—who live there. Portions of the buildings connected with the High Jarrow Chemical Works, belonging to Messrs. Franks and Co., were injured by the storm.

SILKSWORTH.—A violent thunderstorm passed over Silksworth yesterday. The electric fluid struck a cottage, and cut it completely in two. Fortunately, no person was injured.

STOCKTON.—An immense chimney in course of erection at the Tees Bridge Iron-works, was cracked by a flash, and considerable damage was done.

SUNDERLAND.—Yesterday afternoon, a few minutes before two o'clock, a terrific thunderstorm, which has not been exceeded in violence or intensity for a great number of years, broke over the town of Sunderland, and caused a considerable amount of damage. The lightning was of the most vivid description, and flash succeeded flash with extraordinary rapidity, while, at the height of the storm, the thunder was almost a continuous roar. This terrible elemental war continued for at least half-an-hour, and many experienced ship-masters declared that they had never seen anything to approach it in violence. The force of the storm gradually subsided; but the lightning, thunder, and rain did not finally cease until after five o'clock. The rainfall was extraordinarily heavy, and the slope of High-street assumed the appearance of a mountain torrent, while in the slack below there was a perfect flood, owing to the high tide and rain pressure choking the sewers. During the height of the storm, the terrible rain was accompanied by hail, and at one time hailstones as large as marbles fell, followed by a shower of what were literally pieces of ice. A woman, who took refuge in the doorway of a shop in High-street, had her forehead struck and marked by one of these falling pieces of ice. They appeared, however, to fall most thickly at the harbour mouth and South Dock, where some were found of 1½ inches in diameter, and where, too, the storm seemed to have the centre of its intensity. On the east side of the dock the lightning struck the large Goliath crane belonging to the River Wear Commissioners, and smashed it absolutely to atoms. Fortunately the crane did no damage in its fall, and, wonderful to say, none of the tall masts of shipping near had attracted the lightning. During the storm the wind veered round from S.W. to N., and then to N.N.E.

NORTHUMBERLAND.

NEWCASTLE.—It would require the memory of the "oldest inhabitant" to recall a parallel to the dreadful thunderstorm which visited this district yesterday. We have

to recur for a comparison to the same date as yesterday in the year 1839, and even that storm, which deluged the lower parts of the town and destroyed a great amount of property, was exceeded in its violence and in the disastrousness of its results by the electric commotion and pluvial outburst of yesterday. The morning was clear and bright, but the atmosphere was extremely warm and oppressive. The sky grew overcast towards noon, the air became warmer and heavier, and the darkness and density of the clouds indicated a thunderstorm. Between twelve and one o'clock, distant peals of thunder were heard from the south-west; and about one, rain drops, which appeared on the pavement as large as a crown-piece, began to fall. Soon the storm burst, but did not at once reach the extreme of its violence. The thunder which the first shower accompanied, appeared to be directly over the west part of the town, and the sheet lightning, which was first observed, for a moment dazzled the eyes of all on whom it was reflected. A slight cessation in the downpour was followed by a fall of volumes of water. There were a few loud, rolling, successive peals, and then the heavens resounded with a number of sharp, crashing, simultaneous reports. Overhead was one mass of dark and seemingly immovable cloud. The storm was not confined to one quarter of the heavens; lightning flashes could be seen in all directions, and it was difficult to indicate the part from which any of the thunder peals came. The darkness increased; the density of the atmosphere, together with the smell of the sulphurous emanations, became most oppressive; and the ordinary avocations of the inhabitants were suspended, while the loud thunder peals and the long shooting lines of light, coloured with blue and violet, inspired terror and aroused interest. The electric storm had reached its height, when the rain, which was descending in torrents, gave place gradually to hail. The hail shower came down with great force, and lasted several minutes. Some of the hailstones were half and some three-quarters of an inch in diameter, and small pieces of ice mingled with the shower. The storm lasted an hour and twenty minutes. We record below more than one fatal occurrence; numerous instances of damage to property are also reported; but it is impossible to chronicle the whole of the results of the storm, or to compute the total of the disasters. The lightning struck dead one man in a house in the town, and scorched and stunned others; it shattered trees and injured front gardens. The situation of Newcastle renders the lower parts of the town particularly liable to damage by sudden and severe rainfalls; and when destruction is visible, as it is now in the high parts, it can be conceived that the low levels have suffered greatly. The rain and hail deluged the streets in the high parts; the gutter-streams widened as they flowed; and in steep streets, such as Dean-street, there were floods; which, in their impetuous course, did injury to almost every shop and house. The sewers became over-charged, and burst in several places; and when the storm had abated, and the water had ceased to flow, the gutters and street-sides were covered with mud-heaps, and many of the pavements were in a similar condition. The town contains scarcely a single street in which there is not a house with window-panes broken by the hail; and every building whose roof is partly of glass—such as the Central Station—has been injured in a similar manner. At No. 3, Regent-street, Forth-street, a young man named William Mitchell, 22 years of age, was killed by the lightning. In Forth-street, a short distance from Regent-street, Mrs. Anderson, wife of Sergeant Anderson of the Newcastle Police Force, was struck by the lightning. The force of the water which came in torrents down the Tuthill Stairs was so great that it broke away a large number of the stone steps, and carried them into the Close. The chimney and a portion of the stone work of the roof of a house at the west end of the same street were knocked down by the lightning. At a quarter to two the main sewer crossing the Sandhill from the side of the river, built at a time when the town was less than half its present size, became choked up with water, and burst, throwing a column of filth about five feet square to a height of eight or nine feet, resembling an Icelandic geyser, and continuing to discharge itself for nearly half an hour. The water thus liberated ran in a rapid orrent straight to the river, shutting in the inmates of the houses on the east side of

the Sandhill, and filling all the cellars. The pavement, too, between Printing-court-buildings and the new Royal Assurance Buildings was raised up for two or three courses, and the Quay-wall seriously injured. Mr. Sutherland's bar, No. 4, Sandhill, was filled with water, and his cellars were inundated, a very large stock of ales being damaged and rendered unfit for use. At the East end of the town the thunderstorm wrought damage of the most severe and serious character. Stockbridge, lying at the foot of Manor-street, and approached from another high part of the town by Pandon Bank, presented the appearance of a perfect reservoir, being the receptacle for heavy floods which poured with great velocity down these two named thoroughfares. Nelly Brown, a woman who was crossing from the foot of Manor-street, was washed completely from her feet and carried by the running flood towards the row of low dingy-looking structures at the bottom of the Stockbridge, where she was rescued after some difficulty. At the Burn Bank brewery, Mr. J. Mitchell's, jun., another scene of desolation was to be witnessed, a great portion of the flood from Pandon Bank and the Stockbridge having found outlet along Pandon, it rushed down Burn Bank, in the direction of the Quayside, carrying with it doors and shutters which it had brought away from the shops upon Stockbridge. The ale and valuable hop cellars of the brewery were deluged in a very short space of time, and notwithstanding the immediate employment of twenty men whom Mr. Mitchell set to work to save some of the stock, all effort was in vain, and the loss is estimated to be somewhat extensive. The keeper of the Corporation Toll House in Scotswood Road, and his wife, were knocked down by the lightning, which made a strange noise in the house, and caused considerable alarm.

RYHOPE COLLIERY.—The storm was experienced here in all its intensity, and owing probably to the elevated position of the colliery village, several places were struck by the lightning. At the colliery office, part of the roof was carried away, and the same thing happened to a house in Ryhope-street, and to two or three houses in Cory-street. Throughout the colliery, the village, and neighbourhood, the storm was felt very severely, and the rainfall was unusually heavy.

WALKER.—The damage to property by the flood was more or less severe in this locality. The low cooperage at the Walker Chemical Works was flooded, and a lot of bleaching powder destroyed. Before the water could be got away again apertures had to be made in the walls, under the direction of Mr. Wm. Cail, the manager, the dining-room of whose house was also inundated. At the works the air-pumps were choked with the water, and as the engine kept going, the cog wheels were all broken. Fortunately, another set was on hand, and the damage was soon remedied.

WESTMORELAND.

APPLEBY.—Two men were struck by lightning at the Militia Camp, near Appleby, on Tuesday afternoon.

KIRBY LONSDALE.—At Barbon, near here, Miss Batty, aged 76, was found dead in her house, which had been much injured by a flash; and at the same place John Punch, a painter, was found in a dying state, but by prompt treatment he was somewhat restored.

MONMOUTH.

LLANFRECHFA GRANGE.—18th. T at 1.30 p.m. 19th. TS, 7.25 to 11 a.m.; rain from 7.40 to 11.30 a.m.; violent hailstorm four miles to S.—*F. J. Mitchell.*

WALES.

PRESTEIGN, RADNORSHIRE.—Monday, the 17th, there was some thunder and lightning in the evening, after four very hot days. Tues-

day, at 11 a.m., a black cloud came up from the S., and a short, very sharp thunderstorm took place, and $\cdot 17$ in. of rain fell in 17 minutes, and a spruce tree on the public promenade here was struck, 30 feet from the ground, and the lightning ran down it, corkscrew fashion, and tore off the wood and bark a foot in width and thickness. At 3.30 p.m. a tremendous storm came up from the S.E., and lasted into the night, with only $\cdot 19$ in. of rain during the whole of it. A groom was taking two horses to a field, a quarter of a mile from here, when the lightning struck and split a tree 20 yards in front of him, and knocked down one of the horses, but did not hurt it. At Fittey, a village three miles from here, 27 sheep were killed, and a man, a few hundred yards from them had his watch partially fused, and stopped at 4.15 p.m. His hat was cut, and in his head he had a hole the size of an orange, and his boots and stockings were split; a surgeon saw him next day, a friend of mine, and he said he was then quite offensive. The same afternoon, between 3 and 4 miles away, at Beresford, three ewes and three lambs were killed, and a hen turkey and her brood; and a carter told me large lumps of ice fell. Again, on Wednesday (19th), at 9 a.m., another fearful cloud, as black as ink, came up from the S., and a bad storm arose, lasting till 11 a.m., and from 9 to 12 a.m. $\cdot 63$ in. of rain fell, and I had to breakfast at 9 a.m. by candlelight. I don't think this storm did any damage, but all I can gather point to the storms of Tuesday as being the worst known here for years and years—certainly to my knowledge in 16 years. I may here add our rainfall to the 20th of June now is $23\cdot 57$ in., whereas last year to the same date it was only $13\cdot 30$ in.—*P. R. Hannam.*

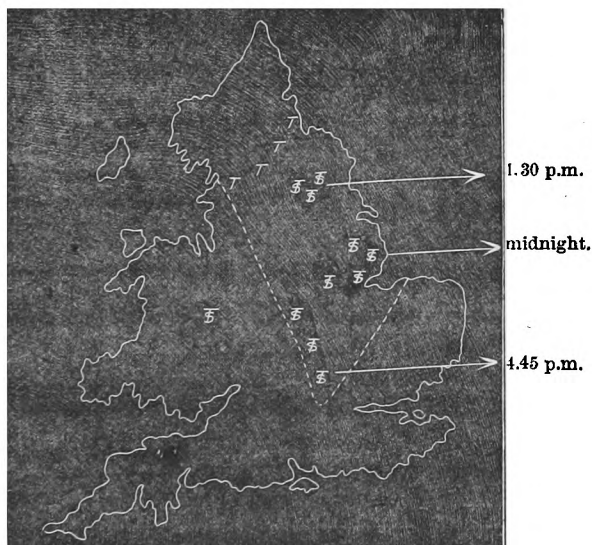
TREVALYN HALL, WREXHAM.—Tuesday, June 18th.—Very high temp. a.m., and fine (max. in shade, $84^{\circ} 2$) p.m.; almost continuous thunder. Three principal storms, viz., at 12.30, 3.30, and 9 p.m., but thunder heard constantly, except between 2 and 3.30 p.m.; greatest violence of storm 4 p.m., rain falling in torrents; amount $1\cdot 29$ in. The storms appeared to move chiefly from S.E. to S.; lightning very brilliant and frequent after 9 p.m., continuing to be seen far into the night. Wednesday, June 19th—Dense cloud canopy; temp. at 9 a.m. 71° ; at 10.15 an extraordinary obscuration, caused by dense black masses of clouds moving from S. at a low elevation. For some minutes it was too dark to read anything but the very largest print, and as the obscuration passed away the thunderstorm broke; rain fell heavily ($0\cdot 435$ in.), but the storm did not last very long. June 24th, Monday—After a brisk fall of the barometer, a thunderstorm began at 3 p.m., subsided about 4, but returned at 4.30 p.m. with increased violence. Rain fell very heavily both in the afternoon and again at 9 p.m., when another thunderstorm occurred; amount of rain $1\cdot 01$ in. A horse was killed by the lightning at about 4.30 p.m. in the park here, at a distance of about 400 yards from the house. Meadows near the Dee flooded in places, and much damage done to hay crops.—*Boscawen T. Griffith.*

PLAS BRERETON.—18th. Very vivid L and loud T.—*T. Turner.*

There must necessarily be some limit to the detail in which we can discuss these storms, and with a view to simplifying, concentrating, and therefore we hope rendering our remarks most useful, we shall consider the events of each day separately.

Of the storms of the 17th, we have not many more than a score of accounts, and therefore our inferences may, by more ample data, be proved incorrect, and although we do not anticipate any such result, we desire it to be understood that all deductions are open to correction by further information. The following chart shews the general features which, with the solitary exception of a local storm at Presteign, are very consistent and apparently simple. (1) Neither thunder nor lightning is reported except from stations north of the dotted line, (2) There was a rather heavy storm passed from a few miles N.W. of York, over that city, and onwards towards Driffield and the coast, between noon and 3 p.m. (3) There was a very slight storm in North Middlesex about 4.45 p.m. (4) There was a sharp storm in Northamptonshire about 7 p.m. (5) There was a violent storm in Lincolnshire about midnight. It is possible that (4) and (5) were the development of (3) and that it gradually travelled due N., but if so it is rather strange that so careful an observer as Mr. Stow should have heard nothing of it, and only seen it at 9 p.m. as "distant L in N."

Thunderstorms of June 17th, 1872.



The storms of the 18th seem also tolerably easy of explanation. The storm mentioned in the account of the 17th (5) as prevailing in Lincolnshire at midnight, again appears as a storm in the same district at 1 a.m. on 18th; its area is roughly indicated by the dotted space marked (c.) The storm which prevailed over the West of England between 11 a.m. and 2 p.m. (marked E) may have passed to N.E. and

become that marked (D), but there is no record from the intervening district. It seems, nevertheless, somewhat probable, as (D) cannot be (F) gone northward, since there is a distinct record of "no thunder" from the intervening district. Our own opinion is that the Watford storm, (F) was a purely local phenomenon, and did not travel far. We are inclined to assign a similar stationary character to the Tyneside storm (A), which for electric intensity was probably the fiercest of all, just as the Kettering storm (D) seems to have been the most productive of rain, if we consider the area of heavy rain as well as its amount. The largest fall actually recorded was (4.27 in.) at Macclesfield, just on the northern edge of (E), and if it be held that (D) was not (E) shifted to north-east, it would perhaps be permissible to suggest that the heavy fall at Macclesfield and thence to the Peak district, was due to a partial mingling of (D) and (E). It will be observed that with the exception of Devon (storm G), there was an entire absence of thunder and lightning in the east, south, and south-west of England. The Devonshire storm set in at the southermost part of Devon about 6 p.m., and gradually later further north, so that it began nearly three hours later in the neighbourhood of Exeter; all over the county it was, however, in full force from 9 p.m. till nearly midnight.

Thunderstorms of June 18th, 1872.



In the early morning hours of 19th storms were in full progress in Devon, and also in central Wales. Just as south Devon was the first by three hours to be visited by the storm on the evening of the 18th, it was first by three hours in welcoming its departure, which occurred in south Devon at 4 a.m., and in north Devon not till 7 a.m.; thence it seems to have passed up the valley of the Severn, and faded away in the west Midland counties shortly before noon. *Possibly, but not,*

we think, probably, we may recognize it again in the Winchmore Hill storm at 2 p.m., which passed Audley End at 3.15 p.m., Sudbury at 4 p.m., and reached Ipswich at 6 p.m. The difficulty in accepting this explanation lies in the fact that several careful observers within the dotted space report "no thunder;" another, though lesser difficulty, is that if the Devonshire storm be supposed to have spread fanlike over the country, it does not seem very obvious why it should have spread northwards so much faster than it did eastwards. The velocity of the wind will scarcely account for it, for there was hardly any motion in the air. Difference of barometric pressure will not account for it, for remarkable uniformity of pressure existed throughout the day, London and Manchester scarcely ever differing more than 0.02 inch. What then was the reason?

Thunderstorms of June 19th, 1872.



THE STORM OF JUNE 24TH.

CROWBOROUGH BEACON, TUNBRIDGE WELLS.—It may interest some of your readers to have a few notes of the remarkable storms which passed over Sussex and Kent on June 24th. The early morning of that day was fine, but sultry, and about noon some highly electric masses of cloud were moving slowly and in various directions. Distant thunder was soon heard from the westward, which continued more or less all the afternoon. There was a slight shower about 5.40, and at 6 a large mass of composite and highly electric cloud came up from S.W., opposed by a lateral current from E.S.E. As the storm approached, its eastern border was remarkably well defined, which at 6.15 proved to be a violent hailstorm, with little or no rain, and only two flashes of lightning. It lasted about twenty minutes, and passed over to the

N.E., where it soon met another storm which had passed over Hailsham, Brightling, and Wadhurst. Upon their junction, the whole mass appeared to remain nearly stationary for an hour, in the neighbourhood of Maidstone, during which time the rain poured down in torrents. At this observatory a large number of the stones were from 3 to 3½ inches in circumference, and few were of less size than an ordinary hazel nut. Mr. Patmore, of Heron's Ghyll, Buxted, situated about 3 miles to the south of Crowborough, wrote to me almost immediately after the storm, and his description of the character of the hailstones is so accurate, that I quote his remarks. He noticed the following facts:—"1st. Exactly half an inch of water fell, and nine-tenths of it must have been in certainly less than four minutes. 2nd. The mass of the hail shower consisted of stones somewhat, but not much, under half-an-inch in diameter; these were spherical and opaque, like ordinary hailstones. Among them were scattered a vast number of stones about three-fourths of an inch in diameter, spherical and opaque, and consisted, like ordinary hailstones, of concentric layers of ice; the largest I picked up, as it lay in my warm hand, melted into a tablet, in which I counted six of these layers, like the transverse section of a six-year old sapling. But besides these, which were only hailstones of an extraordinary size, there were hundreds of lumps of clear ice, most of which had a distinctly crystalline form. Some of these were square, others eight-cornered tablets, such as would be formed by the figure of one square within, or upon, another of equal size. These tablets were usually about an inch on the side, and about one-third of an inch thick. Many of these tablets had projecting limbs from two, and these two always the opposite sides, making their entire length often fully one inch and a half. The largest masses of all were formless, and resembled the coiled and sometimes hollow lumps formed by molten lead dropped in water; one of these was quite as large as a pigeon's egg, and was hollow. 3rd. These great masses of clear ice fell with lightness and softness, that reminded me almost of the way in which great flakes of semi-molten snow falls." I can corroborate Mr. Patmore's statement as to the lightness of these large hailstones, from the fact of my having only one pane of glass broken in the greenhouse, when it would not have surprised me to have found half of them broken.—*C. L. Prince.*

THE STORM OF JULY 25TH.

WANTAGE.—The curious phenomenon of a whirlwind was witnessed in this town and neighbourhood yesterday, July 25th, and though of only local occurrence, you may deem some details worthy of a place among the records of the storms which are such an extraordinary feature this summer. In the morning we had a very explosive thunder-storm, which brought nearly an inch (0.90) of rain. Soon after 3 p.m. a second storm began to gather up, and vast masses of cumuli met overhead from opposite quarters, N. and S., with wandering currents

of vaporous clouds from other directions. Both the thunder and rain however passed off in half-an-hour, and then occurred a sudden rush of wind from eastwards. It lasted one minute, and the results here were not particularly serious. A whirling cloud of dust, a violent slamming of open doors all round the market place, a few shop blinds displaced, a chimney blown down, and all was over. But the effects were more conspicuous three miles to the north-west. At Challon station, between Didcot and Swindon, a signal-post and lamp were carried off to a considerable distance. Close to the station is a large timber-yard, with three wooden sheds covering saw-pits; the three sheds were all uplifted, the planks were whirled about in the air, and some passed over the station inn. A large saw was broken in two, and the men hid themselves among the trees of timber to escape the flying planks. The inn itself suffered most; every chimney pot was dislodged, the slates ploughed up for a yard wide, a dovecot destroyed, lead sheeting torn up and deposited on an adjoining cottage, 15 feet of strong palisading laid flat, &c. From an open bed-room window, a looking-glass and various items of jewellery were swept out and carried not less than 150 yards. A tradesman of Wantage seeing the commotion in the air, took refuge in a shed attached to the inn, but at that moment the wide door was wrenched off and fell heavily upon him; before he could recover himself, a number of planks from the timber-yard, each three or four feet long, showered on his head and body, struck him with great violence, and bruised him most severely.—*E. C. Davey.*

P.S.—I have since learnt other facts in proof of the violence of the wind last Thursday. A truck on a siding was driven on to the main line, forced over the protecting blocks, and on through gravel for 60 yards. Heavy baulks of timber, which require three men to carry, were thrown several yards. One of the men declared that the planks flew about “just like swallows,” but I think his imagination was like Byron’s, “boiling and o’erwrought.”—*E. C. D.*

EVAPORATION.

SIR,—Dr. Ballot says, “What sort of atmometer is most to be recommended for the indication of the quantity of water evaporated from the surface of water? Shall we use the common one, or those proposed by Viviani, Lamont, or Prestel?”

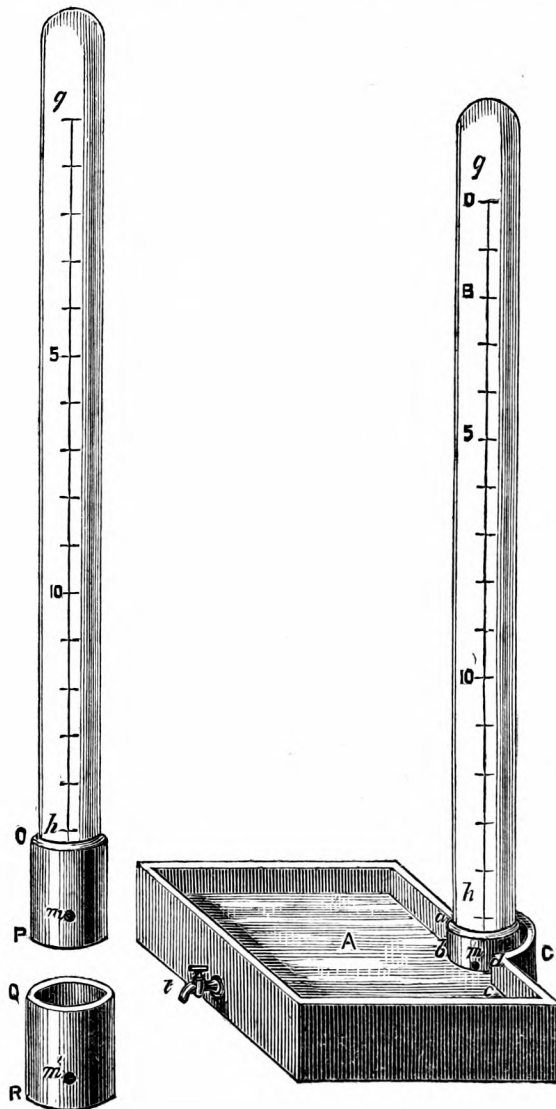
Would you inform your readers what methods were suggested by those gentlemen. It might be very useful for them to know.

I am, Sir, yours truly,

SAM. H. MILLER.

[We have much pleasure in complying with Mr. Miller’s request, and append the following description of Prestel’s apparatus, extracted from the *Proceedings Meteorological Society*, Vol. III., pp. 338-339.

“The following engravings will render its general design easily under-



stood. A is an open square vessel to contain the water to be evaporated ; B C a measuring tube with an opening *m* through which there is a communication between the interior of the tube and the water in A. The water which evaporates from A will be continually replaced from that in the tube through the opening *m*. Thus the water in A will be always kept at the same height, the quantity evaporated after the tube has been filled and fixed in its place being read off from the scale *g h* on the measuring tube.

"The opening *a b c d* being closed with a slide made of fine wire gauze fixed in a frame, and the vessel A filled with sand, mould, turf,

or with earth thickly covered with vegetation, the quantity of water evaporated from these substances can be read off from the scale of the measuring tube as easily as before, and the co-efficient of evaporation determined.

"I have had the instruments made of various sizes, and furnished with various measures. For observations of the same kind, all have given results which agree very well."

After recounting some unsuccessful arrangements for closing the aperture at *m*, Dr. Prestel proceeds, "I have therefore now given to the measuring tube the following simple and successful mounting, which is more easily constructed than the valve, shuts closer after the tube is filled, and what is of more importance, the interior of the tube can be reached through it, and its surface cleaned and polished each time before it is refilled.

"This mounting consists of a ring of thin brass, *o p* fig. 2, into which the open end of the tube is forced about half the breadth of the ring, and there firmly soldered. In the lower half of the ring a semi-circular [shown in the engraving as circular—*Ed. M.M.*] opening *m* is filed, having a radius of about 0.1 inch. On to this ring a cap of brass, *q r*, fits tightly. In the side of the cap there is also an opening, *m'*, which may be brought exactly over the opening *m* by turning the cap, which will allow the water in the measuring-tube to flow out into the vessel *A*, if the tube is in the cylinder *c* attached to the vessel *A*. To fill the tube, hold the open end upwards, closing the hole *m*, at the same time, with the finger, pour in the water, and then force on the cap *q r*, but so that *m* and *m'* shall not come together. Invert the tube, and place it thus closed and filled in the cylinder *c*, fig. 1; then turn it round so that *m* shall coincide with *m'*, and then there will be a free communication between the water in the measuring tube and that in the evaporating vessel.

"Now turn the tap *t*, and let enough water flow off to bring the top of the column of water in the measuring-tube down to the zero of the scale. The shortening of the column of water in the measuring-tube for any time afterwards can be read off from the attached scale, and will give, if subtracted from the previous reading, the amount of water evaporated since that reading."

GAUGES TILTED AT 45°.

To the Editor of the Meteorological Magazine.

SIR,—I am inclined to think Mr. Warren's explanation substantially correct, although it is scarcely likely that the deflection of rain from the vertical is nearly as great at Aldershot as at Hawsker, where there is twice as much wind. The greater density of rain deflected at a greater angle will be partially corrected in many cases by the more direct fall of the less dense rain into the tilted gauge. Suppose the angle at 30 ft., 56°, and at 6 ft., 50°, then the density of rain should be as 64 : 56, but the area of aperture as 98 : 996, the amount caught,

therefore, as 100 : 88. The elevation difference for such a (winter) rain at Aldershot appears to be about 75 : 100 (being 81 : 100 for the whole year between 6 ft. and 25 ft.); this would more than counter-balance the above gain. On the contrary, however, the gauge at 30 ft. *exceeds* that at 6 ft., in winter, by about one per cent. ; this would seem to imply that only a part of the elevation difference affects tilted gauges. This may be the case, although that portion of it due to vertical currents would affect them, since they cause a real increase of rain *where the gauge is*. But one can only guess in this matter.--
Your obedient servant,

F. W. STOW.

Harpenden, St. Albans.

ART AND METEOROLOGY.

To the Editor of the Meteorological Magazine.

SIR,—I have read with much interest Mr. Haviland's letter on "Art and Meteorology" which appeared in the last number of your magazine. I trust it will direct the attention of many artists to a study which must enhance the interest and beauty of their works, and at the same time add a new power to aid scientific students of weather in the solution of their puzzling problems.

I have myself done something in the way proposed by Mr. Haviland, though necessarily in a desultory and imperfect manner. Within the last four years I have made more than 200 studies of skies, with notes of date, locality, and subsequent weather. These I shall have much pleasure in showing to any one whom you or Mr. Haviland may furnish with a card of recommendation.

If my studies are such as may be thought useful to the meteorologist, I shall gladly give to them more systematic attention for the future.

I am, Sir, yours obediently,

WM. BAKER.

197, *Adelaide Road, St. John's Wood, July 28th, 1872.*

THE RAINFALL OF JULY 26TH.

CARDIFF.—A storm of rain fell in this neighbourhood this morning about 2 o'clock, accompanied with lightning and thunder. The rain fell in sheets for a considerable time, completely flooding the roads, and some of the lower stories of the houses. The fury of the storm appeared to be about due east, but the atmosphere in an arc of 90 to 100 degrees was highly disturbed, the sheet lightning from the northern portion being of a pink colour, whilst that from the E. and S.E. being of a pale blue. The thunder, although at some distance, was incessant, and the lightning extremely vivid and very rapid in succession, illuminating the atmosphere with a continuous blaze of pink and blue light. The storm abated about 2.30 a.m. The amount of rain in my gauges was, Ely .87, Lisvane .97 ; wind S.S.W.—*Thos. G. South.*

JULY, 1872.

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.			
											inches.	in.	
I.	Camden Town	2.57	+ .78	.89	23	13	92.3	25	47.2	31	0	0	
II.	Maidstone (Linton Park)	2.21	+ .23	.49	12	15	93.0	25	46.0	19	0	0	
"	Selborne (The Wakes)	3.49	+ 1.29	1.46	24	14	82.5	25	43.0	31	0	0	
III.	Hitchin	2.27	+ .37	.45	7	18	82.0	25	44.0	30	0	0	
"	Banbury	4.43	+ 2.37	1.50	6	17	85.0	21	42.5	31	0	0	
IV.	Bury St. Edmunds (Culford)	6.21	+ 4.22	1.39	23	15	86.0	25	43.0	2	0	0	
V.	Bridport	3.93	+ 1.82	.82	13	12	81.0	25	45.0	3, 4	...	...
"	Barnstaple	6.35	+ 3.49	3.00	6	16	89.0	22	50.0	12	...	...
"	Bodmin	3.25	+ .14	1.98	6	12	75.0	20	51.0	5	0	0	
VI.	Cirencester	4.65	+ 2.21	1.29	29	12	...	...	...	...	...	...
"	Shiffnal (Haughton Hall)	3.84	+ 1.67	1.01	7	11	80.0	21+	43.0	10	0	...	
"	Tenbury (Orleton)	3.71	+ 1.33	.85	25	13	85.6	21	41.5	31	0	0	
VII.	Leicester (Wigston)	5.88	+ 3.78	1.34	9	16	90.0	21	42.0	30	...	...
"	Boston	3.31	+ 1.01	.75	12	14	88.0	21	47.4	18	0	0	
"	Grimsby (Killingholme)	4.84	...	1.93	12	12	83.0	22	47.0	16+	0	...	
"	Derby	4.68	+ 2.49	1.12	6	13	86.0	21	46.0	10	...	...
VIII.	Manchester	7.66	+ 4.97	4.00?	12*	17	89.0	21	43.0	31	0	0	
IX.	York	4.30	+ 2.36	1.35	12	13	83.0	22	47.0	4	0	0	
"	Skipton (Arncliffe)	3.42	+ .19	.71	11	16	86.0	21	40.0	17	...	...
X.	North Shields	2.39	+ .58	.48	26	18	81.0	21	46.8	10	0	0	
"	Borrowdale (Seathwaite)	5.90	— 2.24	1.30	7	12	...	...	...	...	...	...
XI.	Cardiff (Ely)	5.25	+ 2.10	2.15	7	10	...	...	...	...	...	...
"	Haverfordwest	4.61	+ 1.31	1.93	7	11	78.0	21	44.5	9	...	...
"	Rhayader (Cefnfaes)	5.43	+ 2.58	2.35	6	17	78.0	...	...	...	...	...
"	Llandudno	3.46	+ 1.17	1.62	7	12	83.7	21	47.1	10	...	...
XII.	Dumfries	4.01	+ 1.76	1.45	7	13	77.0	28	41.0	10	...	...
"	Hawick (Silverbut Hall)	5.62	...	1.52	26	15	...	...	...	...	...	...
XIV.	Ayr (Auchendrane House)	2.94	+ .78	1.04	7	12	78.0	26	39.0	10	0	0	
XV.	Castle Toward	4.83	+ 1.69	1.00	8	14	...	...	...	...	...	...
XVI.	Leven (Nookton)	3.37	+ 1.10	.79	27	11	79.0	5	39.0	17	0	1	
"	Stirling (Deanston)	3.65	+ .25	.90	7	15	78.0	28	36.4	18	0	1	
"	Logierait	3.41	...	.75	12	12	80.0	5	40.0	9, 16	...	...
XVII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...
"	Aberdeen	1.99	...	.56	7	19	75.8	4	44.3	18	0	0
XVIII.	Inverness (Culloden)	3.14	...	.81	26	13	74.2	5	46.7	17	0	0
"	Portree	4.30	— 1.77	1.51	20	19	...	...	...	...	...	...
"	Loch Broom	1.80	...	.35	8	20	...	...	...	...	...	...
XIX.	Helmsdale	2.62	...	.64	20	18	...	...	...	...	...	...
"	Sandwick	2.60	+ .71	.46	28	16	71.8	5	47.0	19	0	0	
XX.	Cork	6.94	...	1.34	25	14	...	...	...	...	...	...
"	Waterford	2.76	— .55	.58	30	15	75.0	14	43.0	1	0	...	
"	Killaloe	1.89	— 1.30	.35	1	17	82.0	16	44.0	8	...	...
XXI.	Portarlington	2.62	— .92	.64	29	19	77.5	4	47.0	1	...	...
"	Monkstown .....	.99	— 1.44	.24	25	10	84.5	5	42.0	16	0	0
XXII.	Galway	2.80	...	1.22	26	15	75.0	29	51.0	20§	0	...	
"	Bunninadden (Doo Castle)	3.15	...	...	...	...	...	...	...	...	...	...
XXIII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...
"	Waringstown	3.11	...	1.15	25	12	84.0	26	43.0	16	...	...
"	Strabane (Leckpatrick) .....	...	...	...	...	...	...	...	...	...	...	...

* And 13. † And 22. ‡ And 17, 18. § And 27.

+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.

LINTON PARK.—A remarkable month for the frequency of T, but not near here, and perhaps we have had fewer rain storms than most of our neighbours, and no H, the general character of the weather being a few hot days followed by a period of dull cold weather, then again hot. Mostly hot from 18th to 29th, with T most of these days, the last two days cool. Ther. ranged above 80° on 15 days, the 25th being the hottest day; wind changed often but never high. Rainfall about the average, and the same may be said of the temp. of the month as a whole, the cold period detracting so much from the hot ones. Harvest later than usual. Bar. never reached $30^{\circ}00$ during the month.

SELBORNE.—Bar. steady but rather low; temp. very oppressive, the max. on the 25th higher than I have ever recorded during the last ten years, the nights also were warm, and the min. on the 26th the highest I ever recorded in the same period the electrical disturbances unusually great. The thunderstorm on the morning of the 25th was accompanied by torrents of R, 1.50 in. fell in about half-an-hour; near Petersfield, about 7 miles from hence, 5 horses were knocked down, two of them killed, and three men much injured. In the storm of 30th a cottage on Short Heath in this parish was struck by L, the chimney and woodwork shattered, and the thatch set on fire.

HITCHIN.—Constant TSS throughout the month, but none within a mile or two of this station. Highest night temp. ever recorded on 26th.

BANBURY.—Sudden and violent electric wind before TS on 6th; 1.25 in. of R fell in an hour; a second storm very severe and lasting till 7.15 p.m.; 0.40 in. of R fell in half-an-hour soon after noon on 7th; short storm on 18th man and horse struck at the bottom of the town, but not much injured. Bright meteors on 22nd and 25th, on the former day a little before 9 p.m., while still light; three thunderstorms on 25th, first very near and severe. Tree on the outskirts of the town struck in the 4 p.m. storm; T and L almost incessant from 8.30 to far into night; L very fine, much damage done in the neighbourhood by these storms; trees blown down by the wind on 6th.

CULFORD.—This has been a month of extreme heat, excessive R and much T. The rainfall, 6.21 in., is greatly in excess of any single month during the last 16 years. Max. temp. of month 86° on 25th, and the min. or lowest night temp. of that date was as high as 64° ; during the early part of the night of this day (viz. 25th,) the south-western sky was incessantly illumined by the most brilliant flashes of L unaccompanied by T. Mean temp. of the month 64° .

BRIDPORT.—From the 14th to 23rd no R fell, fine sunshiny days, sheet L on 6th, 13th, and 23rd, and on the 25th it illuminated the whole heavens, T on 22nd and 25th. Heavy R on the night of the 6th, 0.82 in. in about 5 hours in night of 13th, 0.62 in. in 3 hours of the early morning of 24th, and 0.65 in. in the night of 25th, when the min. temp. during the night did not fall below 63° registered on morning of 26th.

BODMIN.—A heavy and long continued TS. Rainfall 1.98, the heaviest recorded during the past six years. Average bar. 29.97 , average temp. $63^{\circ}.8$.

CIRENCESTER.—On the 25th a heavy TS, which did considerable damage in the neighbourhood.

HAUGHTON HALL.—A month remarkable for severe TSS. On 7th, at 5.30 p.m., a fearful one with violent R and H. On 25th another almost tropical commencing at 4 p.m. in S.E., met by another from S.W., and a third from N., the L most vivid and T continuous till 7, without a minute's interval, but no H, the sheet L afterwards till 11.30 wonderfully fine. Bar. remarkably steady during month. Temp. high, 62° on nights of 24th and 25th; wind chiefly from N.W. and S.W. No wasps or hornets, scarcely any butterflies, not even white ones. Foxgloves unusually numerous and fine, scarcely any hay undamaged.

ORLETON.—Temp. about $2^{\circ}.2$ above the average; many bright hot days,

followed by great storms of T and L, and violent R. Bar. steady, and but little affected by the great falls of R. A violent TS occurred about 4 p.m. on the 7th, with a fall of .840 of R; about two miles from here more than 2.00 inches must have fallen, as the brooks were higher than ever remembered; Teme overflowed its banks, and covered the meadows before morning; a summer flood has not done so since 1839. On the 25th a violent TS set in about 8.30 a.m.; by 9, 0.300 of R had fallen, and in 12 minutes more than 0.500 had poured down in sheets of R; at 9.30 the R ceased, and about 10 the sun burst out. At 3 p.m. another TS commenced in E.S.S., and crossed to N.E. of us, with brilliant L and loud T at a distance of seven or eight miles, passing off to the N. at 5 p.m.; as night drew on, L recommenced; at about 10 p.m., for the space of an hour, the flashes averaged 30 a minute, and the T clouds one beyond another, as revealed by the L, were grand beyond any former display. The lowest temp. on the night of the 24-25th was 63°·8, and 25-26th, 65°.

WIGSTON.—The month has been characterized by very frequent and unusually violent storms of T, R and H. The temp. above the mean, and rainfall more than double the average for the month. The high temp. of the last fortnight has brought forward the corn rapidly, the pastures never finer both in quantity and quality.

BOSTON.—Very hot all the month, with frequent electrical disturbances of the atmosphere. TSS on 6th, 9th, 11th, 12th, 13th, 14th, and 23rd. Max. of month 88° on 21st, on which day 129.5 was registered in the sun by the blackened bulb *in vacuo*.

GRIMSBY.—The wettest July for many years past. This place has enjoyed its usual immunity from the heavy TSS which have been so frequent in other parts. Fruit scarce, much hay seriously damaged.

DERBY.—This month will always be remembered as one of the most wonderful in recollection; the TSS were magnificent in appearance, but, contrary to the usual experience, failed to lower the temp., the air throughout the month varying but a few degrees. The rainfall for the month is nearly double the average, the temp. exceeded the mean by 4°.

MANCHESTER.—The rainfall on the 12th and 13th, amounting to 4.00 in 35 hours, caused a most disastrous flood in the Medlock. The week ending July 27th had a mean temp. of 72.8, being 12° above the mean (for July) of the last twenty-three years, and 15.2 above the corresponding week of last year. On 29th, during a TS, hailstones fell measuring one-third of an inch in diameter.

ARNcliffe.—A most unusual amount of T and L during the month.

N. SHIELDS.—TSS on 11th, 14th, 22nd, 25th and 26th.

SEATHWITE.—T on 7th, 8th, 9th, 11th, 12th, 22nd to 25th, and on 29th.

W A L E S.

HAVERFORDWEST.—Ther. reached 70° on 13 days, the average night temp. 55°, so, that although we had not more than 4 days during the month which could be considered as very hot, yet the temperature was about the average for July; the hay crops were very heavy, oats look well and likely to give a heavy yield, wheat and barley not so good, all green crops luxuriant; the month has been very wet and more than the usual T and L. A storm of terrific character occurred on the 25th. General health very good, no epidemic prevailing, no cases of zymotic disease. A tremendous storm of wind and R on 7th, doing great damage to the hay crops, 1.93 in. fell in 23 hours. The storm of the 25th commenced here at 12.15 a.m.; during the whole of the day the heat had been very oppressive, sky cloudy, thick copper coloured haze, great stillness, temp. 76°, continuing high all the afternoon and evening; towards midnight an almost Egyptian darkness prevailed; distant T heard at 11.45 p.m., and faint L seen coming nearer and nearer till the storm burst in all its grandeur, the roar of the T for more than an hour was continuous, sometimes resembling the blasting of rocks, then the smart crack of the rifle, then the roar of artillery; the L was incessant extremely vivid and at times very forked. The storm was unaccompanied by R during the first hour of its continuance, it lasted till 3 a.m. and extended over the whole county, it travelled in a curve from S.E. to S. and W.N.W. Amongst the casualties six cows and a bull were killed at Lawhaden, and a barn and outbuildings set on fire at Park-clas.

CEFNFAES.—Temperature variable, wind S.W., last four days N.E.; frost on 30th and 31st; T frequent on 6th and 25th, very violent, and the L remarkable; hay harvest dilatory.

LLANDUDNO.—TS at 9 a.m. on 7th, and again at 7.30 p.m. on same day; on 22nd clouds close down into the seat at noon, T at 6 a.m.; 24th very fine T and L during the night, but no R. Slight TS at 9 a.m. on 25th, clouds down into the seat till 1 p.m., afterwards fine till 11 p.m. then a TS. T in the distance 9.36 a.m. on 26th, a fine rainbow at 5.30 p.m. on 27th.

SCOTLAND.

DUMFRIES.—First six days fine, on 7th excessive rainfall (1.45), weather wet until the 14th, then fine to the 23rd; much R and TS the four following days; the month closed fine. T on 11th, 12th, 22nd, 24th, 25th, 26th and 27th. Rainfall 1.40 above the average of the last five year, temp. $61^{\circ}7$, or $1^{\circ}5$ higher than corresponding month. Crops of all kinds look well, but are three weeks later than last year.

SILVERBUT HALL.—Fine warm growing month with a deal of thunder-rain, 1.20 fell in an hour on the night of the 10th, which flooded many houses in Hawick; a severe TS on the 26th, when 1.52 of R was registered, which brought the rivers in full flood. The whole of the country round here is looking beautiful.

AUCHENDRANE.—This month has been remarkable over the British Isles for violent TSS and heavy floods, but these have not been so severe here as in other places; including all the thunder plumps, yielding 1.04 on the 7th, and 1.24 on 25th and 26th, the rainfall this month here is little above the July mean, and not including the thunder plumps or rainfall, is far below the July mean, and the air beside being warm has been dry, as the humidity was 2° below the mean for July. The river was in full flood only on four days; the TSS of 25th and 26th were most alarming, particularly during the night and early morning of the 26th, since the erection of a L conductor the protection to the house has been complete; but on two previous occasions, two of the large neighbouring trees had been struck and totally destroyed.

CASTLE TOWARD.—From 1st to 13th dull and cloudy, with R almost daily, heavy fall (1.00) and flood on 8th; 13th to 24th fine and warm, distant T on 12th. Strong wind on 20th from S.E. doing much damage to the exposed fruit trees; on 24th and 25th a great TS; during the night of 25th the L was frightful. Crops of all sorts look well, hay in abundance, pasture for cattle plentiful, the month on the whole has been good for carrying on out-door employment.

NOOKTON.—T and heavy R from 6 to 7 p.m. on 25th, T on 26th.

DEANSTON.—First week of the month little rain, hot and sunshiny, second week wet, mild and little wind, third week hot and dry to 19th, then rainy till 27th. 25th and 26th much R, and distant T on 26th.

LOGIERAIT.—A month of genial weather.

ABERDEEN.—A month of very dull quiet weather with frequent fogs often very dense, high night temp. and rather low day temp. Potatoe blight first seen on 18th, TS on 24th, also silent L at night.

CULLODEN.—T on 22nd and 26th,

PORTREE.—On the whole a fine month. Potatoe blight making great progress in both gardens and fields, hay crop generally secured, T and L from 6 p.m. till 9 p.m. on 24th, and from 6 a.m. to 8 a.m. on 25th.

LOCHBROOM.—A dry and good working month but upon the whole an unusually cold month.

SANDWICK.—July has been 0.24 in. wetter, and $1^{\circ}15$ warmer, than the mean during the whole period of observation. There has been rapid vegetation, superabundance of grass, and a promising appearance of grain crops. A peal of T and several flashes of L on 28th, about 11 p.m.

IRELAND.

MONKSTOWN.—A fine warm month, T and L on morning of 25th at 5 a.m.

GALWAY.—Thunderstorm on 26th.

DOO CASTLE.—A fine month.

WARINGSTOWN.—Fine warm month with occasional rain, tremendous TSS and rain on 12th and 25th.

S Y M O N S'S

MONTHLY

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LXXX.]

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THE BRITISH ASSOCIATION AT BRIGHTON.

IN accordance with precedent we give a list of some of those persons more or less connected with Meteorology, who were present at the recent meeting :—

Banks, J.	Hastings.	McCullough, Dr.	Abergavenny.
Birt, W. R.	Walthamstow.	Mann, R. J. ...	London.
Cholmeley, Rev. Dr.	Findon.	Muirhead, H., M.D.	Cambuslang.
Curley, T.	Hereford.	Mylne, R. W. ...	London.
De Fonvielle, W.	Paris	Noble, Captn.	Maresfield.
Dines, G.	London.	Pengelly, W., F.R.S.	Torquay.
Evans, J.	Hemel Hempstead.	Phillips, Prof. J., F.R.S.	Oxford.
Everett, Prof. J. D.	Belfast.	Prestwich, J., F.R.S.	London.
Galton, F., F.R.S.	London.	Prince, C. L.	Uckfield.
Glaisher, J., F.R.S.	Blackheath.	Sawyer, F. E.	Brighton.
Harris, W. J.	Worthing.	Smith, B. W.	Hampstead.
Harrison, J. P.	Ewhurst.	Smith, D.	Birmingham.
Healey, G.	Windermere.	Smyth, J., Jun.	Banbridge.
Herschel, Prof.	Newcastle-on-Tyne.	Strange, Col.	London.
Howlett, Rev. F.	Alton.	Symons, G. J.	„
Hudson, H., M.D.	Cork.	Thomson, Sir W., F.R.S.	Glasgow.
Jansen, M. J.	Paris.	Toller, Dr. ...	Gloucester.
Kebbell, Dr.	Brighton.	Walker, C. V., F.R.S.	Reigate.
Lemoine, G.	Paris.	Wheatstone, Sir C., F.R.S.	London.
Lewis, Captn., R.N.	Hastings.	Woodd, C. H. L.	Hampstead.

The papers bearing directly or indirectly upon Meteorology were :—

- Glaisher, J., Report of Committee on Luminous Meteors.
- Moffatt, Dr. T., On the Tube Ozonometer.
- Everett, Prof. J. D., On Mirage.
- „ „ Report of Committee on Underground Temperature.
- Symons, G. J., Report of Rainfall Committee.
- Macneill, T., Description of the New Mariotti Barometer.
- Dines, G., On a new Hygrometer.
- Phillips, Prof. J., On the Temperature Correction of the Aneroid.
- Meldrum, C., On a Periodicity in the Frequency of Cyclones.
- Boys, Rev. H. A., Meteorological Observations in Greece.
- Sawyer, F. E., Rainfall of Sussex.
- Fonvielle, W. De, On Thunderstorms.
- Strachey, Gen., On the Scope of Scientific Geography, illustrated by Remarks on the Climate of British India.
- Lemoine, Mons. G., Sur les forêts dans leur rapports avec l'Hydrologie.

Brandis, Dr., Geographical distribution of Forests in India.

Janssen, Dr., On a new form of Thermometer for measuring the temperatures of River and Sea Water.

Buchan, A., Temperature of Lake Waters.

Easton, E., The Brighton Waterworks.

LUMINOUS METEORS.

The report was read by Mr. Glaisher, and set forth that more August meteors than usual had been observed, and that the heights of twenty of them had been calculated. The August meteors were very bright; they usually came one at a time and not in a shower, so they were comparatively easy to observe. The November meteors were not so well seen because of unfavourable weather. Much of the report was devoted to the work which had been done in determining the radiant points of the meteors. Only two aërolites had been seen to fall during the year—one in the United States, and the other in France.

The president, in moving a vote of thanks, said that the late Mr. Baden Powell and Mr. Glaisher first began the work of making systematic observations of meteors; afterward Professor A. Herschel entered the same field, and had given the closest attention to the work; more especially, to the determination of the radiant points of meteors, which was the most important part of the subject.

Mr. Symons seconded the vote of thanks.

Professor Herschel said that most meteors were too small to come through the earth's atmosphere without destroying themselves by friction in the upper air; now and then one would come through to the ground, and sometimes fatal accidents had been caused thereby. The "shower" meteors appear to move in the same elliptical orbits as certain comets, but the theory of aërolites which at present best met all the known facts connected with them, was that they were projected from the sun.

The Rev. Mr. Howlett said that he thought that constantly bending back the head to watch for meteors tended to injure the brain, and that couches should be procured, on which observers could watch for meteors with comfort.

A NEW FORM OF THERMOMETER.

M. Janssen exhibited a thermometer for taking the temperature of surface-water in rivers or wells. It may be described as a mop with the thermometer-bulb in its centre. The fibres opened out when the thermometer was lowered into the water, but closed round the bulb as it was raised through the air, and thus prevented its temperature from changing.

TUBE OZONOMETER.

Dr. Russell read a paper prepared by Dr. Moffat on the tube ozonometer, which elicited some discussion as to the value of ozonometric observations conducted by means of iodide of potassium papers. The use of such papers was generally condemned by the members of the Section; but the meeting arrived at no definite conclusion respecting any other way in which the liberation of iodine may be utilized as a measure of ozone.

MIRAGE.

Professor Everett read a paper on Mirage, in the course of which he described an interesting experiment devised by Professor Clerk Maxwell, F.R.S. In this experiment the beautiful effects of Mirage were obtained by means of three liquids, in a cubical vessel with plate glass sides, six inches square, the lowest liquid being a saturated solution of alum, the highest pure water, and between them a thickness of about a quarter of an inch of Scotch whiskey, containing enough sugar to make its specific gravity intermediate between those of the other two liquids. It is much more refractive than either of them. Triple images were obtained, with great distinctness, of all the objects in an extensive landscape, the middle image being inverted, and either elevated or depressed according to the position of the eye. The range of triple vision extended to objects as far as 10° from the horizontal direction, either above or below, and all three images were sufficiently distinct to show whether white blinds were up, down, or half way down in a row of houses at the distance of 700 yards.

Mr. B. H. Babbage (son of the inventor of the calculating machine) described several kinds of mirage which he had seen in Australia. In one instance, the Surveyor-General reported the existence of a large inland lake, which turned out to be mirage. The site in this instance was a swamp.

UNDERGROUND TEMPERATURES.

The "Report of the Committee on Underground Temperature" was then read by Prof. Everett. Father Secchi has undertaken to conduct observations of temperature in the Mont Cenis Tunnel. Thermometers have also been supplied to the Smithsonian Institution, for observations in the great tunnel under the Hoosac Mountain in America, as well as to observers at Ballarat, Moscow, St. Petersburg, and Paris, and to the conductors of the Sub-Wealden Exploration. Observations of great value have already been received from Paris, where Messrs. Mauget and Lippmann, who are sinking for the Municipality of Paris an artesian well, which is already 2,000 feet deep, have taken two series of observations at every 100 mètres of depth. The temperatures observed in the two series are almost identical; but the rate of increase between the depth of 600 mètres and the bottom (660 mètres) is four times more rapid than in the rest of the well. Messrs. Mauget and Lippmann attribute this circumstance to the heat generated by boring, though the tool had not been at work for five weeks previous to the observations. The temperatures at 100 mètres, 600 mètres, and 660 mètres, are respectively 58°·0, 75°·4, and 83°·25 Fahr. Successful observations have also been made in a bore at the bottom of South Hetton Colliery.

Prof. Phillips remarked that the thermometers of his own pattern (Phillips's maximum), to which reference had been made, could be carried round the world without derangement of their indications by shaking down, provided their bore was made sufficiently small, as in the case of some which he constructed long ago, and which were still in his possession. But there would be difficulty in using such instruments where the light was bad, and he thought the instrument exhibited by Prof. Everett (the upright Negretti) was better adapted to the purposes of the Committee.

Mr. Glaisher having stated that the ordinary Negretti thermometer was a result of the Exhibition of 1851,

Prof. Phillips stated that his own thermometer was invented twenty years earlier.

RAINFALL.

Mr. G. J. Symons, Secretary of the Rainfall Committee, produced the report of that committee, which was as follows:—

Your committee have the honour of reporting that every branch of rainfall work continues efficiently maintained, and that, notwithstanding the very limited funds at our disposal, and the long illness of our secretary during the winter, all arrears have been overtaken, and, owing to the completeness of the organization, no hitch or interruption has occurred. At the meeting of the British Association in Edinburgh very strong representations were made to your committee respecting the desirability of establishing additional rain-gauge stations in different parts of the Highlands, and as your committee had long been aware of the necessity which existed for these stations, and, moreover, as somewhat larger funds than usual were at their disposal, they resolved on taking every means in their power to secure the efficient establishment of these stations. In addition to ordinary correspondence, our secretary took two special steps to secure the most promising distribution of the new gauges. In the first place, he wrote to Mr. Buchan, the secretary to the Scottish Meteorological Society, acquainted him with the assent of the committee, and requested him to state for what number of gauges he could provide good observers. On receipt of his reply, ten gauges were sent to him, which he was kind enough to distribute. The other step was to send a letter to the secretary of the Highland Railway Company, whose line, as is probably generally known, traverses much of the most thinly inhabited part of Scotland, asking that their station-masters might be directed to make the requisite observations. To this letter a very favourable reply was received. The result of sub-

sequent correspondence was the establishment of a chain of stations over the entire system of the Highland, and Dingwall and Skye railways. Fifty gauges with pegs for fixing, instructions, and blank observation forms were sent to Inverness and distributed, and erected by the officials of the company at various selected stations, with the exception of a few which are retained in store until the northern extension of the line will enable them to be placed in Sutherland and Caithness. It only remains to add that the station agents, with scarcely an exception, understand their work, and do it punctually and well. Another district in which additional stations are urgently required is that traversed by the Caledonian Canal, and, therefore, a letter similar to the one already quoted, was addressed to the gentleman who, our secretary was informed, was in charge of the canal. As, however, the letter has not been acknowledged, our efforts in that direction have been futile. It is generally the case that expenditure on the part of this Association leads to equal or greater expenditure for similar objects by other persons. This has been specially the case with rainfall work, and an illustration may be quoted from the events of last year. Simultaneously with the above action of the Committee, the Earl of Breadalbane (through his agent, Mr. J. P. Smith, C.E.) has undertaken to supply returns from a series of stations between Aberfeldy and Tyndrum, and other important localities in the watershed of the Tay, and Rannoch. Several of the gauges were fixed by our secretary, and the sites for others selected by him, and if the observations are regularly taken, they will be of great utility. A very limited number of gauges have also been supplied to remote districts of England and Wales, but the price of rain gauges is now so low, that there can be but few persons who are able and willing to take charge of a gauge, to whom the cost can be prohibitory. Your Committee are fully aware that in many parts of the country additional observations are desirable, but there are so many expenses incidental to the collection of the observations and their discussion, that they do not feel justified, considering the very limited means at their disposal, in lending gauges except to very isolated stations. Their secretary will, however, be happy to render any information or assistance in his power, to persons who may be willing to set up gauges, and it is hoped that by the maintenance and development of the present organization, these vacant spaces may gradually be occupied. Owing to the illness of our secretary, the forms of enquiry respecting the positions, &c., of all the rain gauges in the country (not only those belonging to this Association, but also the much more numerous private ones) were not issued so soon as was originally intended. About 1,000 are, however, now circulated, and the rest will follow in less than a month. Those which have been returned have nearly all been filled up in a very complete and satisfactory manner, auguring well for the success of the proposal. Another step taken with the same object, viz., the attainment of precise knowledge respecting the gauges in use, their errors, and position, has been taken during the past year. Our secretary has long possessed a travelling case containing the standard measures necessary for verifying any rain gauge without removing it from its position, and in previous reports we have given the results of several hundred examinations of rain gauges *in situ* made with this apparatus. Owing, however, to our small funds, this examination has necessarily been limited, and as a partial counterpoise to this curtailment, we have caused to be constructed a precisely similar testing case, and have presented it to the Scottish Meteorological Society, whose secretary will in future use it in his inspections of the stations of that Society, and will communicate the results to us. We shall thus obtain a large amount of very valuable information at the mere original cost of the apparatus. We regret that, owing to the cause already referred to, the discussion of the monthly percentages during 1860-69 is not quite ready for publication; the means are all taken, and the whole of the per-centages (some 4000) are worked out; the subsequent discussion, will, we hope, be completed long before it is required for our next report. The only remaining subjects to which we have to direct attention are the biennial tables for 1870-71, which are given in the appendix; and the results of a comparison of the fall in each of those years with the averages at the same stations and with the same instruments during the ten years, 1860-69, given in our last report. This is given in Table I., and an abstract of the same in Table II.

Among the many points of interest brought out by this mode of treatment perhaps the only one to which we need call special attention is the general distribution of rain during 1870 and 1871. And first respecting 1870. The accompanying sketch-map shows that there were two areas in which great deficiency of rain occurred, and that there was no division in which the fall reached the average. The areas of deficiency were the south-west of England and the west of Scotland, and on reference to Table I. it will be found that several stations in those divisions had less than two-thirds of their average fall. The divisions in which the fall most nearly approached the average were the north-east of Scotland and Yorkshire; the latter, owing to a very heavy local fall in North Lincolnshire in October, 1870, having partially extended into the former county. In 1871 the fall was not very much below the average (only five per cent.), and the chart does not reveal such prominent features as in 1870. The greatest differences are found in the two sides of the north of Scotland, no other division differing more than six per cent. from the mean of the whole, and even this is mainly due to a belt of excess running north-eastward across the centre of England. This belt, moreover, is due to a single rain, that of September 6th, which in south-east Yorkshire amounted to nearly 4 in., and to between 1 in. and 2 in. at nearly all stations thence south-westward to Devonshire. The area of that rain it may be as well to state (including only those parts at which upwards of an inch fell) was about 14,000 square miles, and taking the fall at the low average of 1½ in., not less than 1,357,000,000 (thirteen hundred and fifty-seven million) tons of water fell during the twenty-four hours.

A brief discussion ensued, and at its close the President remarked that when it was known to all that the results embodied in the report were obtained mainly through the untiring energy of the secretary, it would be readily admitted that the thanks of the Section were due to Mr. Symons. (Applause.) He regarded the report as of the most reassuring character. (Hear.)

Mr. Symons, in acknowledging the compliment, said that it had been suggested that the committee should apply for government aid, but he deprecated such an idea, and thought it preferable to depend solely upon private enterprise, as otherwise they might, between two stools, find themselves in the traditional position. (Laughter.)

ON A PERIODICITY IN THE FREQUENCY OF CYCLONES IN THE INDIAN OCEAN SOUTH OF THE EQUATOR.

The following paper by Mr. Meldrum was read :—

One of the objects for which the Meteorological Society of Mauritius was established in 1851, was to obtain extracts from the meteorological registers of vessels visiting the harbour of Port Louis, especially of such vessels as had experienced bad weather in the Indian Ocean.

Accordingly, clerks were employed to copy all the log-books that could be procured.

In 1853 the system of registration was remodelled. Instead of having the observations contained in each log-book recorded separately, all the observations in all the log-books for the same day were recorded on the same page.

As this system has been conducted without interruption to the present time, the Society has now a large collection of observations showing more or less the state of the winds and weather over the frequented parts of the Indian Ocean, in the form of a daily journal, during the last nineteen years; so that a person may find at once what weather prevailed on any day or in any year during that period.

Together with the years 1851-2, therefore, during which the registers were differently kept, we have 21 years' continuous observation, from the meridian of Greenwich to 120° E., and from 23° N. to 45° S.

Adding to the information obtained by the Society throughout these 21 years numerous observations collected by several persons for the previous four years (1847-50), we have a more or less complete record of all, or very nearly all, the cyclones which have taken place in the Southern Indian Ocean during the last 25 years; for Mauritius is so much in the track of these cyclones, and so much

visited by vessels in distress, and by others trading between the colony and England, India, and Australia, that it is scarcely possible for any violent hurricane to pass without being noticed.

Taking now, for the present, the area comprised between the equator and the parallel of 25° S., and the meridians of 40° and 110° E., and examining a table of the cyclones that have occurred there from 1847 to 1872, it is found that some years have been remarkable for a frequency and others for a comparative absence of cyclones.

The five years, 1847-51, were characterised by cyclone frequency; then came a period of comparative calm (1852-57), which was followed by six years (1858-63) remarkable for cyclones. The next five years (1864-68) showed a considerable decrease; and since 1869 there has been an increase, until, for the present year (1872), the number of cyclones is already (28th June) greater than in any year since 1861.

What has now been said is not only borne out by the records of the Meteorological Society, which give detailed accounts of the hurricanes, but also, I have little doubt, by the books of the docks and marine establishments.

Especially in 1847-48, and again in 1860-63, the harbour of Port Louis was at times crowded with disabled ships; whereas in the years 1855-57 and 1866-68 there were very few.

It will be seen that these years correspond pretty closely with the maxima and minima epochs of sun-spots.

For the present I wish merely to call attention to the subject, in order that the connection which I think exists between sun-spot frequency and cyclone frequency may be either verified or refuted by past or future observation.

It appears to me that there is more than a mere coincidence as to time. There are three maxima and two minima epochs of cyclone frequency, corresponding nearly, if not entirely, with similar sun-spot epochs.

To examine the matter fully it would be necessary not only to know the number of cyclones in each year, but also the extent and duration of each, and the force of the wind. If we could thus get an expression for the annual amount of cyclonic energy, and could show that it varied directly as the amount of sun-spots, a connection would be established. One violent hurricane, which lasted ten days, and passed over thousands of miles, might have more value than half-a-dozen smaller and short lived ones. However, having traced a large number of the cyclones in question, I have no doubt that the years of greatest cyclone frequency were generally, if not always, the years of greatest cyclone energy; and that the number of cyclones in a year is a fair expression of cyclonic activity for that year.

Now, taking the maxima and minima epochs of the sun-spot period, and one year on each side of them, and comparing the number of cyclones in these three-year periods, we get the following results:—

	Years.		Number of Cyclones in each Year.		Total number of Cyclones.
Max.	{ 1847	..	4	}	15
	{ 1848	...	6		
	{ 1849	...	5		
Min.	{ 1855	...	4	}	8
	{ 1856	...	1		
	{ 1857	...	3		
Max.	{ 1859	...	5	}	21
	{ 1860	...	8		
	{ 1861	...	8		
Min.	{ 1866	...	5	}	9
	{ 1867	...	2		
	{ 1868	...	2		
Max.	{ 1870	...	8	}	14
	{ 1871	...	4		
	{ 1872	...	7		

Taking two years on each side of the solar-spot epochs, we get :—

	Years.		Number of Cyclones.		Total number.
Min.	{ 1854	...	3	}	...
	{ 1855	...	4		
	{ 1856	...	1		
	{ 1857	...	3		
	{ 1858	...	4		
Max.	{ 1858	...	4	}	...
	{ 1859	...	5		
	{ 1860	...	8		
	{ 1861	...	8		
	{ 1862	...	7		
Min.	{ 1865	...	3	}	...
	{ 1866	...	5		
	{ 1867	...	2		
	{ 1868	...	2		
	{ 1869	...	3		

Assuming that we have got a close approximation to the actual number of cyclones, and that the numbers fairly represent cyclonic energy, it is difficult to avoid the conclusion that the above tables point to a definite law; and that meteorology, magnetism, and solar physics are closely connected. For what holds good with regard to a large tract of the Indian Ocean probably holds good with regard to other portions of the earth's surface.

Is it not probable, also, that if there is such a connection as is here suggested between the sun-spots, or sun-cyclones (as they have sometimes been called), and earth-cyclones, there is a similar connection between the sun-spots and cyclones in the other planets?

NEW MARIOTTI BAROMETER.

Mr. G. J. Symons next read a paper on Mr. Telford Macneill's new Mariotti Barometer. It was a little mercurial instrument about a foot long, and in accuracy he considered it to occupy a middle position between the standard barometer and the aneroid.

(To be continued.)

BOOKS RECEIVED.

Observations made at the Magnetical and Meteorological Observatory at Batavia.

By DR. BERGSMÄ. Vol. I. Large 4to.

Quarterly Weather Report. Part IV. Oct.—Dec., 1870. 4to.

Discussion of the Anemometrical Results, furnished by the Anemometer at Sandwich Manse. [From *Quarterly Weather Report*, 1871.] 4to.

Routes for Steamers from Aden to the Straits of Sunda. [Met. Com., non-official, No. 4.] 8vo. Stanford.

Winds, &c., of the North Atlantic. [Met. Com., non-official, No. 5.] 8vo. Stanford.

Scottish Meteorology, 1856—1871. By C. PIAZZI SMYTH. [From *Edinburgh Astronomical Observations*, Vol. XIII.] 4to.

Meteorological Observations at Port Louis, Mauritius, 1868, 1869 and 1870. By C. MELDRUM. Foolscap folio.

Monthly Notices of the Meteorological Society of Mauritius, March to November, 1871. Foolscap folio.

Meteorological Observations in New Zealand, 1869 and 1870. Foolscap folio.

Monthly Abstracts of Meteorological Observations, New Zealand, to December, 1871. Edited by DR. HECTOR, F.R.S. Foolscap folio.

New Zealand Meteorological Report, 1870, including returns for 1869, and abstracts for previous years. By DR. HECTOR, F.R.S. Large 8vo.

On Ocean Currents. By J. CROLL. Parts I., II. and III. [From the *Phil. Mag.*] 3 Parts. 8vo.

Sussex Meteorology, 1871. By F. E. SAWYER, F.M.S. Sm. 8vo. Robinson, Brighton.

Rain, with special reference to the Rainfall of Sussex. By F. E. SAWYER, F.M.S.
Determination of Heights by means of the Thermo-barometer. By F. F. TUCKETT.
 [Reprint from the *Alpine Journal*.] 8vo.

REVIEWS.

A Key to the Seasons and Weather, the result of Forty-two Years' Observations. By JAMES WYATT, F.G.S. 8vo, cloth, 22 pages, 2 plates. London: Arthur Hall & Co.

IF this key really would unlock all the intricacies, and remove all the uncertainties which surround coming weather, it would indeed be a golden key—nay more, it would be invaluable. Considering the more than national benefit which would accrue from the discovery of the laws which regulate or indicate coming seasons, it has always struck us as very remarkable that it is not more generally sought. We suppose the reason is to be found in the wide-spread disgust at the presumption and condign failures of the quacks and charlatans who have made impudent asseveration take the place of careful study, and whose failures simply led them on to greater recklessness. Chemistry has, however, risen from the ashes of alchemy, and astronomy has shaken off the trammels of astrology, and we hope that genuine predictive meteorology will before long take an equally firm position.

As we have already intimated, there are very few who have attacked this problem in a legitimate manner—viz., by careful and honest analysis of long-continued weather records. We think that they might all be counted upon the fingers. In fact, only four occur to us at the present moment—Lieut. George Mackenzie, of Perth, a prolific but by no means lucid writer; Mr. F. W. Doggett, F.M.S., who wrote several papers on the influence of the seasons on the various crops, which were published in the Reports and Proceedings of the Meteorological Society; Mr. G. D. Brumham, F.M.S., who has also contributed some papers to that society, and some to our own pages; and lastly Mr. Wyatt, whose work is now before us.

Irrespective altogether of the value of the rules for coming weather, this little work is acceptable, firstly, because it contains a table of the monthly rainfall in Carnarvonshire since 1825, which is superior to any other in north-west Wales, and of the highest utility in connection with Major Mathew's work in that district; and secondly, because it contains a condensed epitome of the weather during the same long period.

The foregoing remarks will show that our opinion is entirely different from that expressed by Mr. Wyatt in the following paragraph:—

"The author, in giving the result of his forty-two years' observations of the weather, has endeavoured to do it faithfully and correctly, with the view if possible of eliciting any useful and practical information as regards the seasons and the weather that may be serviceable. If it should be thought that he has not succeeded in doing so, then his labours and attention for so many years have been thrown away, and there would appear little use in keeping a diary of the weather at all; but he flatters himself that some useful information may be obtained, and that to withhold it would be doing wrong to himself and the public."

Having thus indicated our opinion that, apart altogether from its predictive portion, the work is a useful one, we must leave the rules laid down to the examination of our readers, merely offering a few passing remarks.

One fundamental rule appears to be that the summer generally will have the same characteristics as the weather between May 20th and June 20th. We are surprised, however, to find the summer of 1852 classed as fine, while according to the author's own table, the rainfall in both June and August was above the average, and July by no means exceptionally dry. Possibly the excess was due to thunderstorms and the intervening weather was fine, but if so, one would have almost expected to find it classed under changeable. Similarly, 1864 would by most meteorologists be entered as a fine summer; Mr. Wyatt has it down as variable, and judged by the amount of rainfall at his station, he might have entered it as wet. From this, two conclusions may be drawn—(1) that the rules most probably should in fairness be compared with the weather of the locality of which the future weather has to be determined, and (2) that the weather in N. Wales often differs widely from that in other parts of England.

One remark to which we are rather inclined to demur is—"Hard winters generally set in at or about Christmas or early in January." If this is true for N. Wales it scarcely holds good for the S.E. of England, and severe frosts usually extend over the whole of Great Britain. According to Mr. Glaisher's paper in the *Philosophical Transactions*, the most severe winters were 1783-4, 1784-5, 1794-5, 1796-7, 1813-14, and 1829-30, of which three began in November or early in December, and the other three later.

On the whole, the work is decidedly useful; the remarks on the character of the weather, as indicated by the movements of the barometer and the wind, are excellent. Many exceedingly valuable hints are given, which must, if carefully attended to, be productive of much practical good to the farmer, &c.

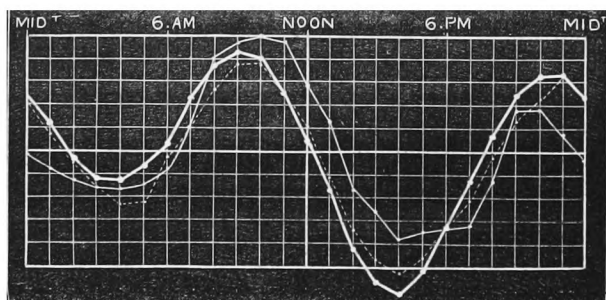
Observations made at the Magnetical and Meteorological Observatory at Batavia. Published by order of the Government of Netherlands India. Vol. I. Printed at the Government Printing Office, Batavia, 1871. Large 4to, 458 pages, 12 plates.

THIS handsome volume reflects credit on all parties concerned in its production, primarily on Dr. P. A. Bergsma, the director of the observatory, and author of the work before us; on his Javanese assistants, of whom Dr. Bergsma has reason to speak favourably; on the lithographers and printers of Batavia for the excellence of the printing, and though last, not least, on the Dutch Government for their establishment and maintenance of the observatory. As it would be altogether beyond the limits of a review minutely to analyze its contents, we must confine our attention to a few points. One of the most remarkable features is the large daily range of the barometer. The instrument

is a syphon standard by J. G. Greiner, jun., of Berlin, its internal diameter is 0.4 inch, and by two microscopes and a vernier it reads to 0.0008 in. (less than $\frac{1}{10000}$ th of an inch); it was read hourly during the years 1866, 1867, and 1868, all the readings have been reduced to 32°, and every calculation has been made twice. The mercury in the short leg of the syphon is 26 feet above the level of the sea. The mean annual pressure, deduced from some 20,000 readings reduced to sea level, is 29.909 in., and the mean at each hour differed from that value by the undernoted amounts:—

Midnight	+0.024 in.	6 a.m.	+0.006 in.	Noon	+0.005 in.	6 p.m.	—0.033 in.
1 a.m.	+0.011 "	7 "	+0.023 "	1 p.m.	—0.019 "	7 "	—0.013 "
2 "	—0.003 "	8 "	+0.038 "	2 "	—0.042 "	8 "	+0.007 "
3 "	—0.011 "	9 "	+0.044 "	3 "	—0.059 "	9 "	+0.024 "
4 "	—0.013 "	10 "	+0.040 "	4 "	—0.062 "	10 "	+0.032 "
5 "	—0.006 "	11 "	+0.026 "	5 "	—0.051 "	11 "	+0.032 "

These values show a larger daily range than has been found at any of the stations of which the curves were given in our May number. We therefore annex a diagram of them, superimposing for comparison the two curves which they most nearly resemble. The thick line is for Batavia, the thin one for Calcutta, and the dotted line for Cumana.



The range at Java amounts to 0.106 in., while at Calcutta and Cumana it is only 0.090 in. The first min. at all three stations occurs a little before 4 a.m., the first max. at Java at 9 a.m., at Cumana between 9 and 10, and at Calcutta at 10 a.m. The second min. is a little before 4 p.m. at all stations, but the second max. occurs at Calcutta at 10 p.m., at Java at 10.26, and at Cumana not till 11 p.m. Thus we see that at Calcutta the max. and min. follow at regular intervals of six hours each, but that at Cumana and at Java the max. do not fall intermediately between the minima, the morning max. falling earlier and the evening ones later than the intermediate hours of 10 a.m. and 10 p.m., and therefore the interval between the morning and evening max. is $13\frac{1}{2}$ hours, while between the evening and morning max. it is only $10\frac{1}{2}$. These results are in close accordance with those obtained during 1846 and 1847 at Batavia and other stations in the Eastern Archipelago by Capt. C. M. Elliot,* upon whose work we may

* Magnetic Survey of the Eastern Archipelago. *Phil. Trans.* 1851, part I.

just remark that it seems probable that at Borneo the daily range is even greater than at Batavia.

Dr. Bergsma has carefully discussed his observations with a view to determining the amount of variation in the barometer due to the moon's position with respect to the meridian, and finds a double tide similar to that of the sun, but of which the amount is less than one-twentieth of the ordinary solar tide. Reckoning from the time of the moon's upper transit (or southing, as many persons would call it,) the following are the results :—

	in.	h.		Variation.	Interval.
	in.	h.		in.	h.
1st maximum =	29·885	at 1.04	.....	—·005	... .. 6.08
1st minimum =	29·880	„ 7.12	.....	+·004	..... 5.53
2nd maximum =	29·884	„ 12.65	.....	—·005	... .. 5.97
2nd minimum =	29·879	„ 18.62	.....	+·006	..... 6.42

These values are very similar to those deduced by General Sabine* for St. Helena, the differences being that the variation is slightly greater at Java than at St. Helena, and that Dr. Bergsma has computed the precise epochs of maximum and minimum by Bessel's formula, while General Sabine, merely taking the nearest whole hour, assigned the max. and min. to the following lunar hours, 0, 6, 12, 18. It will be noticed that at Java the epochs are all later, and it will be interesting to know which is most usual, and whether the retardation is the same all over the globe.

We must now turn to another subject. Dr. Bergsma evidently intends to make his work as perfect as possible, and is quite prodigal with his labour ; all honour to one who sins in this direction, but in one respect he must excuse us for saying that he has mistaken extreme precision for extreme accuracy. This at first sight looks like a paradox or blundering expression on our part, but we know not how else to characterize the following facts. Dr. Bergsma sets a good example to many directors of observatories by describing briefly (more details would have been better) the construction and position of his instruments. His rain gauge has an area of about 248 inches (whether round, in which case diam. = 18 in., or square, when side = 16 in., is not stated,) and is on the top of the principal building of the observatory, 3 ft. 4 in. above the highest point of the roof, and about 33 ft. above the ground. Now table CIV, “contains the number of rainy days in every month and in the whole year ; every day on which 0·1^{mm} of rain fell, has been taken as a rainy day.”

Our readers will hardly need reminding that 0·1^{mm} equals 0·004 in., that at 33 ft. above the ground only a very rough indication of the true rainfall will be obtained, and that in a climate whose mean annual temperature is nearly 80°, the funnel of a rain gauge will generally be so hot as to evaporate the first drops of each shower. We do not know of what material the funnel of the Batavia gauge is made, but

* *Magnetical and Meteorological Observations, St. Helena, 1840-43, p. 98.*

we are certain that entries (of which we see many), of 0·1^{mm} are misleading; when 0·1^{mm} finds its way into the measuring glass, we have little doubt that at least three or four times that amount has fallen. We admit that when 0·1^{mm} is entered, nearly a cubic inch of water has been collected, and therefore it seems a tangible and reliable measurement—but there are generally two ways of looking at any question. Does anybody suppose that if a single drop of water fell on a piece of hot metal one inch square, any large proportion of it would run off. Do we not know that it requires a second and a third drop, coming nearly in the same place, before anything would run off. Yet a record of 0·004 in. is a record of less than one rain drop per square inch. We are not citing Dr. Bergsma as the initiator of a bad system, but he seems so zealous a worker that we desire to call his attention to the difficulty. Considering the height of the rain gauge above the ground, it seems probable that the recorded fall is not more than 80 or 90 per cent. of that which would be collected by a gauge with a receiving surface 1 ft. above the ground. We hope that Dr. Bergsma will shortly be provided with a second gauge, and will so place it that its results will be comparable with other stations.

Meanwhile, we are very glad to be able to place before our readers the monthly amounts collected by the present gauge, converted of course into English measures :—

Rainfall at Batavia, Java.

Lat. 6° 11' 0" S.; Lon. 106° 49' 45" E. Rain gauge above ground, 33 feet ;
above sea, 56 ft.

Year.....	1864.	1865.	1866.	1867.	1868.	MEANS.
	in.	in.	in.	in.	in.	in.
Jan.	20·16	24·61	8·47	20·67	10·16	16·81
Feb.	7·68	4·53	24·57	24·49	9·17	14·09
March....	5·63	8·66	4·68	2·24	7·09	5·66
April....	3·58	6·89	3·42	1·85	3·86	3·92
May.....	1·81	·75	14·45	·67	·55	3·65
June.....	2·79	10·04	·24	1·38	1·14	3·12
July.....	2·60	1·57	·39	2·91	3·15	2·12
Aug.	3·03	4·88	·16	1·34	6·69	3·22
Sept.....	2·28	1·69	5·63	3·35	·24	2·64
Oct.	7·32	·20	6·81	10·31	3·58	5·64
Nov.....	3·23	10·20	2·83	5·83	4·02	5·22
Dec.....	4·73	9·45	17·72	21·42	7·48	12·16
Total....	64·84	83·47	89·37	96·46	57·13	78·25

The observatory does not appear to possess max. and min. thermometers, but as both the Kew standard and the dry and wet bulb thermometers are read every hour, there is no difficulty in ascertaining the mean annual temperature, which is 78°·8. The extremes are not given, but we have not noticed a higher temperature than 92°·3, which occurred at 2 p.m. September 14th, 1868, nor a lower one than 68°·7 at 6 a.m. on August 11th, 1866.

AUGUST, 1872.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which ≥1 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.	Min.		In shade	On grass.				
				Dpth	Date.						Deg.	Date.	Deg.	Date.
inches	inches.	in.			Deg.	Date.	Deg.	Date.						
I.	Camden Town	2·05	—	·59	·38	25	12	83·0	17	43·4	28	0	0	
II.	Maidstone (Linton Park)	1·35	—	1·36	·35	5	12	84·0	17	38·0	31	...	...
III.	Selborne (The Wakes)	2·03	—	1·15	·76	21	11	73·0	18*	37·5	28	0	1?	
IV.	Hitchin	1·50	—	·85	·33	7	13	73·0	21†	42·0	26	0	...	
V.	Banbury	2·84	+	·71	·69	2	14	80·0	18	39·0	28	0	...	
VI.	Bury St. Edmunds (Culford)	2·49	+	·05	·90	7	11	75·0	17†	42·0	14	0	0	
VII.	Bridport	1·16	—	1·43	...	...	11	79·0	18	41·0	13	0	0
VIII.	Barnstaple	2·82	—	1·37	·62	1	14	84·5	19	45·0	9, 28	...	...
IX.	Bodmin	2·22	—	1·64	·47	4	12	72·0	24	46·0	14	0	0	
X.	Cirencester	2·27	—	·57	·58	2	18	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall)	4·21	+	1·34	1·19	7	18	75·0	18	42·0	28	0	...	
XII.	Tenbury (Orleton)	2·57	—	·31	·75	7	13	81·7	18	41·2	28	0	...	
XIII.	Leicester (Wigston)	3·44	+	1·25	1·02	5	15	85·0	17‡	43·0	27	...	...
XIV.	Boston	3·73	+	1·44	·86	2	14	81·0	17	42·0	28	0	0	
XV.	Grimsby (Killingholme)	3·02	—	...	·47	26	21	74·0	17	45·0	4, 28	0	...	
XVI.	Derby	3·34	+	·74	·84	25	17	80·0	18	46·0	1, 28	0	0	
XVII.	Manchester	2·78	—	·72	·58	7	20	83·8	18	46·0	27	0	0	
XVIII.	York	2·81	+	·10	·38	9	16	76·0	18	41·5	24	0	0	
XIX.	Skipton (Arncliffe) ...	4·58	—	1·36	·85	10	20	78·0	20	37·0	3	...	...
XX.	North Shields	3·71	+	·86	·79	12	21	72·2	17	45·2	4	0	0	
XXI.	Borrowdale (Seathwaite)	9·34	—	4·74	1·62	28	16	...	...	...	...	...	...
XXII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest	2·02	—	2·86	·50	9	12	77·2	18	40·0	12	0	...	
XXIV.	Rhayader (Cefnfaes)	4·34	—	·32	1·20	6	20	77·0	...	41·0	...	...	...
XXV.	Llandudno ...	2·15	—	1·67	·34	10	15	86·0	18	46·8	9	...	...
XXVI.	Dumfries	3·04	—	·84	·64	25	15	78·0	18	42·0	27	...	...
XXVII.	Hawick (Silverbut Hall) ...	4·22	...	...	·69	12	19	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	4·19	+	·22	·77	29	16	78·0	18§	41·0	5||	0	0	
XXIX.	Castle Toward	6·33	+	·03	1·83	17	15	73·5	18	...	...	...	...
XXX.	Leven (Nookton)	5·98	+	2·99	2·16	25	21	69·0	18	40·0	1, 4	0	0	
XXXI.	Stirling (Deanston)	6·26	+	1·64	1·27	16	22	74·0	19	40·8	31	0	0	
XXXII.	Logierait	2·88	...	...	·76	25	18	75·0	19*	40·0	31	...	...
XXXIII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Aberdeen	3·37	...	...	·60	24	20	65·9	19	42·8	6	0	3
XXXV.	Inverness (Culloden)	2·41	...	...	1·21	12	15	65·2	20	46·5	9	0	0
XXXVI.	Portree	3·11	—	4·34	1·02	16	11	...	...	...	...	...	...
XXXVII.	Loch Broom	2·77	...	...	·88	10	18	...	...	...	...	...	...
XXXVIII.	Helmsdale	2·99	...	...	·80	11	17	...	...	...	...	...	...
XXXIX.	Sandwick	3·40	—	·31	·67	6	13	63·1	18	43·6	14	0	4	
XL.	Cork	6·83	...	...	1·46	9	15	...	...	...	...	...	...
XLI.	Waterford ...	4·25	+	·30	1·05	15	16	74·0	23	45·0	13	0	...	
XLII.	Killaloe	5·01	+	1·06	·89	21	18	79·0	18	41·0?	13	...	...
XLIII.	Portarlington	3·61	—	·89	·59	6	20	75·0	18	44·0	13	0	...	
XLIV.	Monkstown	3·83	+	·62	1·07	5	19	...	...	...	...	...	...
XLV.	Galway	5·25	...	...	1·03	14	15	80·0	19	54·0	4**	0	...
XLVI.	Bunninadden (Doo Castle) ...	4·28	...	...	...	...	...	...	...	...	...	...	...
XLVII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	4·30	...	...	·83	25	16	81·0	4	39·0	8	0	...
XLIX.	Strabane (Leckpatrick)	5·66	...	...	1·30	6	16	...	...	...	...	...	...

* And 22. † And 25. ‡ And 18. § And 19. || And 14, 15. ** And 10, 15.

+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.

LINTON PARK.—The first 11 days dull and showery, with distant T at times; the remainder of the month fine and dry, the third week being hot. Wind (never high) mostly N.E., when it was fine, but changeable during the early part of the month. Dense fogs on the mornings of the 25th and 29th, while on low lands it is said that there was a perceptible frost on 31st, but, on the whole, the month may be regarded as a fine one.

SELBORNE.—On the whole a good harvest month; the crops got in well; wind very changeable; distant T on 2nd and 4th; bright aurora from 9 p.m. on 5th; very boisterous day on 11th; fogs on 14th and 19th.

BANBURY.—TS on 2nd, and again from 1 to 5 p.m. on 7th; R and H on 31st.

CULFORD.—Fine weather from the 10th to the 25th; the last two days very cold for the season; easterly winds prevailed during 12 days, westerly 19; the mean temp. of the month is 59°; R fell on 11 days, that of the 7th amounting to .90 in; TS on 2nd, 7th, and 31st.

BRIDPORT.—Fine month; harvest nearly completed by the 31st; gale on the 10th.

SHIFNAL.—R every day with one exception (3rd) till the 11th; bar. very equable, never reaching 30 in. or falling below 29 in.; max. temp. only 5 days above 70°, viz., 17th, 18th, 20th, 21st, and 24th; distant T on 2nd at 1 p.m., and 6th at 3 p.m.; violent TS on 7th at 5 p.m., when most of the R (1.19) fell, but no H; harvest begun (on 10th) on light soils; crops good, better than on strong soils; nearly finished at the end of the month on light soils, and got in well; 25th, a few wasps at length appear, but the bees eat the plums, &c., nearly as badly as they.

ORLETON.—The first 10 days cold and wet, with great TSS on 2nd and 7th. On the former day about .40 in. fell in 20 minutes, and on the 7th the storm continued stationary for nearly 3 hours, with a fall of .75 of R; the remainder of the month was beautiful harvest weather, being fine, hot, and dry; T was heard on the 2nd, 6th, 7th, and 9th, and L seen on 21st; the mean temp. was half a degree less than the average of the month, and nearly 4° below that of last August.

WIGSTON.—The last three weeks of the month have been, upon the whole, favourable for harvest work, and the greater part of the wheat and oats has been secured in good condition; a violent TS, of short duration, occurred on the 26th, unaccompanied by much R; considerable damage done to property in Leicester by the L.

BOSTON.—Severe TSS occurred on the 2nd, 7th, and 31st; on the 8th .25 in. of R fell in ten minutes.

GRIMSBY.—Very little fruit; the potatoe disease universal, and foot and mouth disease very general; wheat crops light, and the turnip crops on strong land very poor owing to ravages from the fly; T on 2nd; L on 4th; TS at 6 p.m., on 5th; TS at 11.40 a.m., and another at 1.30 p.m., on 26th; T and L at 7.50 p.m. on 30th.

DERBY.—An unlucky month for farming operations, only eight consecutive days without rain; the fall above the average, the temp. just the mean. Potatoes here are reported to be very bad indeed; the wind has been unusually variable, not three following days in the same direction; bar. pressure below the mean.

MANCHESTER.—May and August this year have been the only months (here) below the average, the rainfall to the end of August being 11 in. above the average of 78 years; very few shooting stars seen (here) on the 10th, the sky being overcast.

N. SHIELDS.—TS on 6th, 7th, 11th, and 12th; T on 24th; L on 10th and on 30th, with heavy R on the 10th, but merely showers on the 30th.

W A L E S.

HAVERFORDWEST.—On the whole a fine harvest month; much T and L at times, especially on the 7th, when there was a very heavy storm, T very loud,

L very vivid, flash and crash in the twinkling of an eye succeeding each other ; two houses struck. The storm was limited in its area, and lasted about an hour ; aurora fine on two or three nights towards the end of the month.

CEFNFAES.—Temp. variable, nights generally cold and inclined to frost ; wind S.E. and N.W. ; potatoes much diseased, and rapidly spreading ; foot and mouth ailment amongst the cattle increasing ; TS, and very vivid continuous **L** occasionally.

LLANDUDNO.—**T** on 5th and 7th ; **L** on 6th and 20th ; aurora on 8th, commencing at 8.30 p.m., the colours beautiful at 11.9, also on the 9th at 10 p.m., in the southern hemisphere, and on 14th ; began to cut wheat on the 12th ; hazy on 20th, 21st, 22nd, and 24th, but the weather fine.

SCOTLAND.

DUMFRIES.—Weather very fine for a few days at the beginning of the month ; from 5th to 16th the weather wet and broken, then very fine and warm to the 24th ; at the close the weather unsettled ; harvest began on 9th, and general on 19th ; crops above the average, but potatoes affected with disease ; fruit scarce, but wild fruit, such as bramble, extraordinarily plentiful ; **T** on 7th, 15th, and 25th.

HAWICK.—The rainfall of the month has been mostly of thunder showers ; very violent **TS** on the 12th, when the **L** struck the telegraph wires, and set fire to two ferns in the conservatory ; the continued rains keep back harvest operations, and is aggravating the potatoe disease ; '65 in. of rain fell in two hours (between 5 and 7 p.m.), on the 31st.

AUCHENDRANE.—With clouds plus, and solar radiation and wind both minus, the evaporation has been feeble, on the other hand the rainfall has been above the August mean, and fell on some days like thunder-plumps ; the great **TS** of the 7th, in Glasgow, &c., scarce reached here, neither the earthquake on the 8th, near Stirling, nor the waterspout at Comrie, on the 10th, and at Ben Lomond on the 20th, were felt here. Auroræ were seen here on 11th, 15th, 25th, and 26th ; **L**, with the aurora on the 25th. The fog, which reached from the Forth in the E. to the Clyde in the W. on the 14th, and the great gale of the 16th and 17th along the east coast, did not visit this district. The farmers have found hay-making, &c., rather difficult this August ; the bad state of the potatoe crop is attributed to the excessive electrical condition of the atmosphere ; the rivers have been in their average (August) condition, except when locally affected by **TS**, and such floods were of short duration.

CASTLE TOWARD.—The rainfall this month has exceeded that of August, 1871, by rather more than 2'00 in., but is very little in excess of the average for August ; this has been a very cloudy dull month, and but little sunshine ; 13th to 15th, dense fogs ; 16th and 19th, great floods. Corn crops look well, and harvest operations going on fast, many fields of corn cut in this district ; potatoes very much diseased ; turnips very backward owing to the great rains in July ; garden carrots a failure ; fruit of all kinds (outside) very scarce ; grass in abundance ; on the whole the month has been a favourable one for outdoor employments.

NOOKTON.—Cloudy month ; **T** on 26th and 30th.

DEANSTON.—First week sunshine and showers ; distant **T** on 7th ; on the 8th close and warm ; slight earthquake at 3.30 p.m. at several places near ; on 10th distant **T** without **L** ; from 18th to 24th fair, except slight showers on 21st and 23rd, then much rain, and cold to the end of the month ; potatoe crops generally affected with disease ; harvest at a standstill, and very little grain cut.

LOGIERAIT.—Very unsettled weather ; prospect of an average crop of cereals, with a late harvest ; unmistakable signs of the potatoe disease.

ABERDEEN.—A month of dull, damp, quiet weather, exceedingly unfavourable for the crops ; only small patches of grain cut here and there ; potatoes seriously damaged by blight, in some fields 50 per cent. destroyed ; auroræ on eight nights ; several large meteors seen on 4th ; **TS** on 24th ; bar. and **R** above the average mean temp. and force of wind below the average ; N.E., S.E. and N.W. winds more frequent than the average.

CULLODEN.—Auroræ on 5th, 9th, and 15th. **T** on 7th and 10th. Fog on 19th, 20th, and 21st.

PORTREE.—A very fine month ; hay crops and peat were secured in fine condition ; the potatoe blight is making rapid progress in some fields ; it is feared that seed will not be got safe ; finger-and-toe is also very bad in the turnip crop, in some places one half of the crops is useless ; the island is very healthy, cattle in excellent condition, and sell well at high prices, sheep are also doing well.

LOCHBROOM.—The month has been a fine one ; some of the farmers have their crops cut and nearly housed, and, on the whole, they are further advanced here than in any district in the north ; the potatoe disease has attacked many fields, but a large quantity of plant is still free of the taint.

SANDWICK.—On 8th aurora coruscating to the zenith from 9.45 till midnight ; also on 14th and 25th. Solar halo on 15th and 18th. Large lunar halo on 25th.

I R E L A N D.

WATERFORD.—T on 1st, 7th, 21st and 22nd.

MONKSTOWN.—Beginning of month very wet ; on 9th a few meteors in N.E. up to midnight.

DOO CASTLE.—Beginning of month wet, but on the whole a good month for outdoor employment.

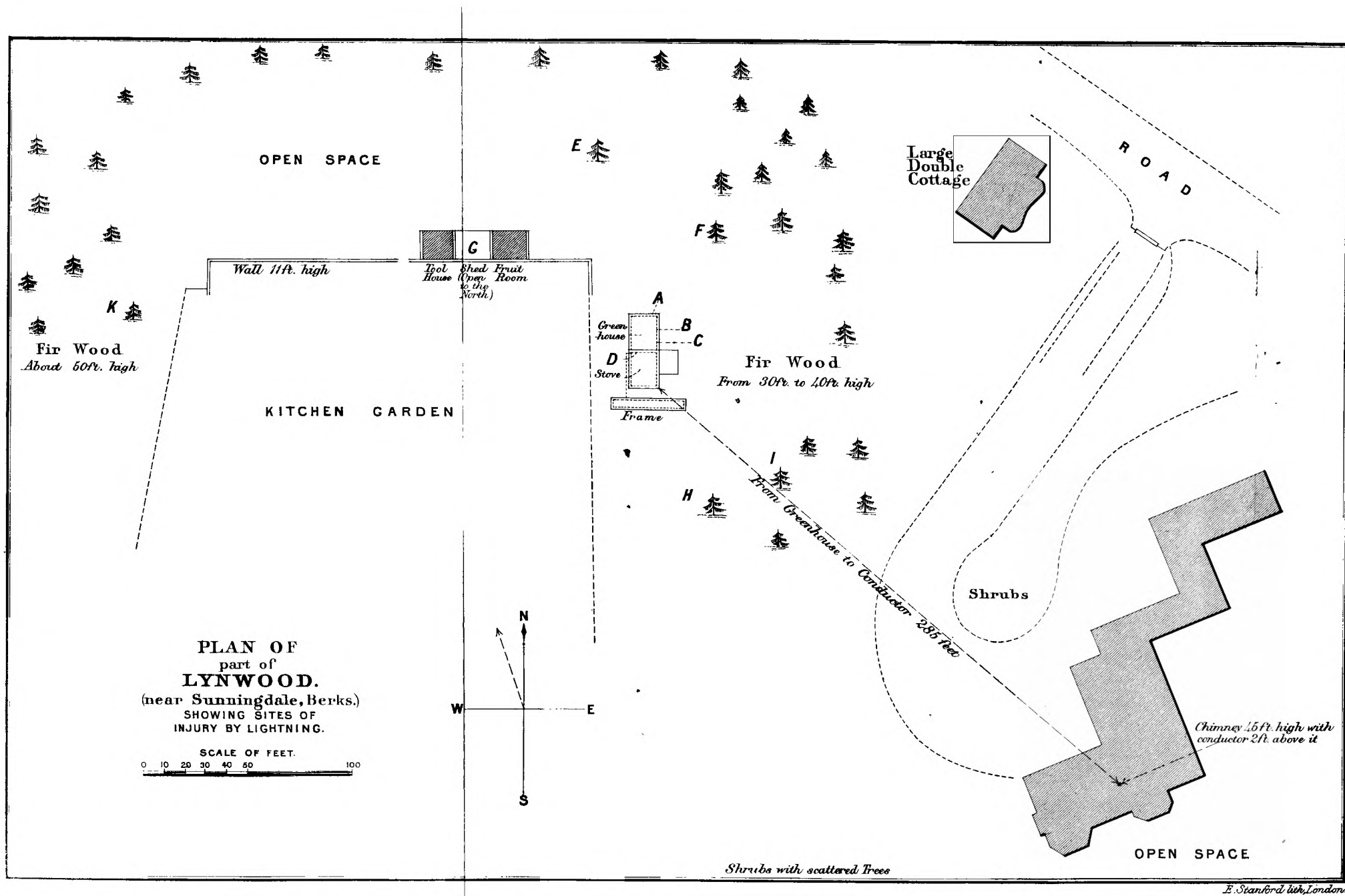
WARINGSTOWN.—The weather during the month was variable, hot sun with heavy TSS.

THE SUMMER OF 1872 COMPARED WITH ITS PREVIOUS INDICATIONS.

To the Editor of the Meteorological Magazine.

SIR,—According to the Greenwich observations, the mean temperature of the three months ending August 31, 1872, has been $61^{\circ}7$, which is considerably ($1^{\circ}6$) above the average of 101 years. This agrees with my forecasts in your numbers for December and March last, Vol. VI. p. 196, and Vol. VII. p. 28. Really hot summer weather commenced a few days after the 9th June last, and if we reckon the three months' summer from that date to about the present time in September, the mean temperature will show a much greater excess over the average. So the summer has been decidedly hot, according to my prediction. In your magazine for May, 1869, (more than three years ago) Vol. IV. p. 58, I showed that fine weather would set in about, or a few days after, the 9th of June, 1872, and that about the 17th of August of the same year (1872) a period of deficient rainfall would occur. Now between the 11th of June and the 6th of July last, the rainfall at the Royal Observatory, Greenwich, amounted to only 0.75 in., which is about 50 per cent. below the average of 57 years, and the most remarkably dry weather of this summer occurred in the last three weeks of August, exactly in accordance with my predictions made more than three years ago. With regard to the fine weather that I predicted for June, Mr. Glaisher, in the "Meteorology of England" for the quarter ending June 30th, 1872, says, "On June 13th a warm period set in, and for some days the weather was fine, bright, and hot. . . . Under the influence of the bright sunshine and hot weather about the middle of June, everything progressed satisfactorily and rapidly." In the *Gardeners' Chronicle and Agricultural Gazette* for April 13th last, (page 508) I stated that the summer rainfall of 1872 would be above the average. At your station the rainfall has been somewhat in excess of the average, and at very many stations the summer rainfall has been excessively large.—I am, &c.,

GEORGE D. BRUMHAM.



SYMONS'S

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METEOROLOGICAL MAGAZINE.

LXXXI.]

OCTOBER, 1872.

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REMARKABLY COMPLEX FLASH OF LIGHTNING.

[THE following narrative is so lucid, that were it an account of an ordinary accident, our duty would merely consist in placing it before our readers, but the facts are so unusual, and are reported by so experienced an observer, that too careful attention cannot be given to the circumstances. It will be noticed that Admiral the Hon. Sir F. W. Grey, Bt., describes it as a "bright double flash" with a "single discharge" of thunder "like that of a gun," and yet we have six separate cases of injury, distinctly isolated, the least intervening space being 35 ft., several spaces more than 50 ft., while altogether they are spread over an area of 315 ft. by 145 ft. Cases of bifurcation, and even trifurcation, are not very unusual, but we know of no parallel to the ramification of this flash, and that it must all be due to one stroke is proved by the expression, "there was no other discharge in the immediate neighbourhood." Among the many puzzles involved in the following narrative perhaps the greatest is the fact that part of the bark of the tree F was found inside the greenhouse. Our impression is that the injury to the greenhouse arose either simply from an upstroke, or from superheated steam being formed in the pipes by either an up or down stroke, the fact of seventeen panes being broken in the end of the greenhouse at A, and most of the glass falling outwards seems to indicate expansion of air or steam inside, and an outrushing current, yet we find the bark of F was propelled with sufficient force to travel 40 or 50 ft., and force its way against the currents and through the shattered window frames. It would at first appear that the injury to F must have occurred later than that to A, as otherwise the glass would not have been broken, and no entrance could have been gained; but the instantaneity of lightning is both proverbial and true, whereas the flight of the fragments of bark would take perhaps two or three seconds, affording ample time for the displacement of the glass. — Ed.]

BERKSHIRE.

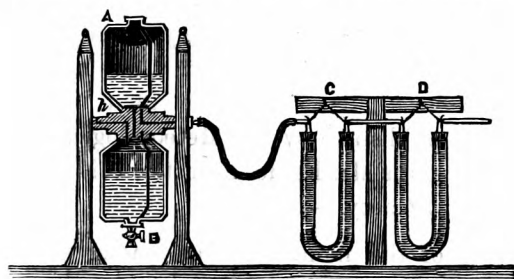
LYNWOOD.—On Saturday, July 13th, the morning was fine, but with thunder-clouds in various directions. About noon these clouds assumed a more threatening appearance, and at 1 p.m. began to rise

more rapidly from the southward ; several claps of thunder were heard, and rain began to fall heavily. About 1.30 there was a bright double flash of lightning, and at the same instant a terrific crash of thunder—one single discharge, like that of a gun. The rain fell in sheets. There was no other discharge in the immediate neighbourhood, and the storm passed away to the N.E. On examination, it was found that the five trees, E, F, H, J, and K, had been struck, that the electric fluid had made a hole in the brick-work of the greenhouse wall at A, about a foot from the ground ; had split the *lower* hot-water pipe at B, broken the joint of the elbow of the *upper* pipe at C, and had burst out large pieces of the lower pipe in the stove at D. The red lead in the joints was disturbed in several places, both in the house and frames ; none of the plants were injured. Two panes in the partition between the stove and greenhouse were broken, and at the end A, 17 panes were broken, the glass chiefly falling outwards. The boiler-house, which is sunk in a pit, and rises only 3 feet above the ground on the outer side, shows no mark whatever. None of the trees near the greenhouse showed any marks more than 10 or 12 feet from the ground. The tree F was most injured, a strip of bark four inches wide being taken off, and the wood laid bare ; some of the bark was carried into the greenhouse. A watering hose was hanging on the tree E, and the bark was most injured between the nozzle and the ground. Two men and a boy were in the shed G, and were thrown against the wall, but were uninjured ; a scythe was hanging up in it, and a considerable quantity of galvanized wire and netting was on the ground. In the greenhouse, pieces of the iron pipe at C were thrown across the house, the force of the explosion apparently acting outwards from the interior of the pipe. The pipes were full, or partly filled with water. Another tree was struck at K, and the earth removed for a short distance from the roots, probably by a separate current. During the passing of the thunder cloud, about seven-tenths of an inch of rain fell, as shown by Pastorelli's storm gauge, and between 10 p.m. and midnight a still heavier fall occurred, so that on the morning of the 14th, 1.62 in. was registered, the heaviest fall registered here in the last five years. The conductor on the dwelling house is about 90 yards from the greenhouse, the space between chiefly occupied by fir trees from 30 to 40 ft. high. The ground is level, but falls to the eastward, the plateau on which the house and garden are, forming part of a ridge running N.E. and S.W. The surrounding country generally undulating and wooded, with Chobham Common to the southward.—*F. W. Grey.*

CHEMICAL HYGROMETER.

[From the *English Mechanic*.]

A hygrometer is an instrument for measuring the degree of saturation of the atmosphere. There are several kinds of hygrometers, one of which I will describe, called the chemical hygrometer. In this hygrometer a given volume of air is made to pass through chloride of calcium, or very strong sulphuric acid which has been previously weighed. The increase of weight shows the amount of moisture in the volume of air. Two brass reservoirs of the same construction, and holding a gallon each, are fixed on the same axis, but on opposite sides, as in the appended figure, and made to turn about it. The interior of each vessel is connected by a central tubulure, and the lower one is always in connection with the air outside by means of tubes running through the axis, while the upper one is connected by means of guttapercha tubes to the tubes c and d, which are filled with chloride of calcium or some porous substance saturated with sulphuric



acid. The tube c prevents any vapour from escaping from the reservoirs to d, and d absorbs the vapour of the air which passes through it. The lower reservoir B being filled with water is inverted, so that the water running slowly from it expels the air in A through the tubulure h which connects it with the air outside. The vacuum now formed in A causes a draught of air through the bent calcium tubes c and d, and the calcium absorbs the moisture in the air which passes through it. When all the water has run into B, the reservoirs are again inverted, and the same process commences again. If the reservoirs have been turned six times, it is evident it is evident that six gallons of air have passed through the tubes c and d, and have been deprived of the moisture in them. The contents of the tubes c and d are then weighed, and the increase of weight gives the amount of vapour contained in six gallons of air at the time of the experiment. I do not think Leslie ever made use of the hygrometer to convert water or mercury into ice. It is true that he converted both water and mercury into ice by a method of rapid evaporation, which I will endeavour to describe. He placed under the receiver of an air pump a vessel containing strong sulphuric acid, and over it a thin metallic shallow box, in which was placed some water. When the air is drawn from the receiver the water boils, and since the vapours are absorbed by the sulphuric acid as soon as they are formed, a rapid evaporation takes place, which soon causes the water or mercury to freeze.—W. H. H. C.

DAILY VARIATION IN THE PREVALENCE OF RAIN
DURING AUGUST, 1872.

[WITH this month's issue we commence a series of brief notes on the daily distribution of rain over the British Islands, thus affording an explanation (necessarily brief and imperfect at first) of the excessive or deficient monthly values reported from different parts of the country. We also intend to give at the end of the year a short summary of the facts thus adduced, and, perhaps, to draw some conclusions from them. It is hoped that by this means we may not only gain a clearer view of the laws which regulate the distribution of rain, but that at the same time some additional light may be thrown on the concurrent conditions of pressure, wind, &c., over our islands. We think it only right that our readers should know the data upon which the remarks are based, and to whom we are indebted for the series of articles. The observations employed are a portion of those sent to ourselves for the formation of our usual monthly table, and some others we receive regularly, supplemented by reference to the daily weather charts published by the Meteorological Committee, and the author of the papers is Mr. Frederic Gaster, F.M.S., Hon. Librarian of the Meteorological Society.—ED.]

At the beginning of the month the barometer stood highest over the north of France, lowest in Norway; and under these circumstances the *prevailing* wind would be, and was, from W. to N.W. Some local disturbance occurred, however, on our north-west coasts, producing an intermingling of the south-westerly current with the more general north-westerly one, in a manner very similar to what is often found in thundery weather. Thunderstorms prevailed in many parts of England during the day, with rain varying from 0.01 in. to 0.81 in. Some fell in Ireland and the west of France also, but scarcely any in Scotland. This weather seems to have travelled slowly to the eastwards, and next day (2nd) we find the storms and rain fell chiefly over southern and south-eastern stations, while in Ireland northerly winds and clearer skies were reported. At 8 a.m., on the 4th, the barometer was really highest over France, but *comparatively* high pressure had also formed over the central and northern parts of Great Britain. Thus while the northerly current of the previous disturbance still held over the east of England, with considerable rain in some places, the southerly wind was restored in the south-west of our islands, where rain had recommenced. The new disturbance crossed our islands very rapidly, but produced little rain except at Dover. What did fall was confined entirely to the southern parts of Ireland and England, and the French stations, but was very general in those neighbourhoods. The morning of the 6th brought new broken weather to the western coasts. A very complicated series of thunderstorms was approaching us, accompanied by a

depression of rather peculiar nature. Already nearly 0·9 in. of rain had fallen on the north-east coast of Ireland, and a less quantity on the other coasts of that country and England. As the day passed the heavier falls travelled to Great Britain, and France was included in the general disturbance. The western districts suffered most, for we find 1·9 in. at Portishead, and 1·2 in. at Rhayader, in the day, while large amounts fell in different parts of Ireland. More than an inch fell at Biarritz, where, in common with our stations, a thunderstorm occurred. On the following day the wet weather moved eastwards, and northerly winds began to return; the sky cleared in Ireland, but England still felt the rain, 1·2 in. falling at Shifnall. Again on the 9th, the old conditions were restored; at eight o'clock the weather was yet very fine, but the barometer was falling in the west, and the southerly current was restored as a light breeze in that region. The new depression was more simple and clearly defined than its predecessor, but its sway more extensive and its influence more uniform. None of our coasts, and only the southern parts of France, escaped without a moderate fall of rain. The disturbance travelled slowly, and it was not until the morning of the 11th that its centre had reached the east coast of Scotland. Rain fell generally each day; first Ireland, then the west of England, and lastly, Scotland, receiving the heaviest falls. It should be noted that in the north and east of Scotland the largest falls appear to have occurred with the northerly or north-westerly winds which prevailed in the rear of the depression. On the 12th the weather was finer, and until the 15th very little general rain occurred anywhere beyond slight showers in Scotland. We must not omit to notice a very local fall of 1·03 in. reported from Galway on the 14th, the only other report for that day being 0·05 in. at Killaloe. During the 15th, however, renewed diminution of pressure was observed in the west, accompanied by an increase over all the eastern stations. The southerly winds were thus restored in our western districts, and were fresh, with rain, while light south-easterly breezes and summer-like weather prevailed in England and France, but as pressure remained very high in the east the disturbances which followed travelled nearly due north, and the wet weather was confined to our most western and northern counties. From the 17th to the 21st the weather was very fine; but on the latter day a slight local depression, such as is constantly associated with thunderstorms, only in this case *very* isolated and clearly defined, showed itself in the south-east of Ireland. A thunderstorm and heavy rain occurred at Roche's Point early in the morning, after which the storm travelled rapidly to the eastwards, heavy rain falling in many parts of the west and south of England, with more or less thunder and lightning. Unhappily, the reports from northern and central France are few, and appear to be of very poor quality, so that the tracing of any disturbance in that country is attended with too great uncertainty to be easily carried out; but it seems that this same disturbance was next morning at Charleville. Some rain fell also at one or two isolated stations in the north of the kingdom, and on the 23rd similar local

showers were reported from some of the midland towns. The morning of the 24th found pressure very uniform in these islands, variable airs and calms prevailing; but in the succeeding twenty-four hours the barometer again fell briskly, chiefly in the west, and rose in France, so that we again had southerly winds established at our western stations, and heavy rain with them; these gradually extended, and on the 25th only the extreme north of Scotland was free from rain. Thunder occurred locally in the north of England, where the rain was heaviest. On the 26th the wind gradually veered northwards throughout the kingdom, and with its advent the rain left us for a while. By the 28th a new slight diminution of pressure had occurred in the extreme north, while uniformly high readings were reported elsewhere; with this slight disturbance we find a renewal of rain at the Scotch stations and in the north of Ireland, extending southwards very gradually till the 30th, when it had reached all places but the extreme south-east of England. On the 30th hail fell at Valencia; thunderstorms were very general in England, and reached some parts of the Continent, and, with some local exceptions, rain fell throughout the country. Very similar weather occurred on the 31st, but both the thunder and rain were less general than on the 30th.

In this notice we have said little as to the quantity of rain measured, except in a few marked cases, but on another occasion it is proposed to discuss the amounts registered during the prevalence of certain distinct conditions of pressure, wind, &c. This will probably be done at the completion of the volume of the year's magazine.

HEAT AS INDICATED BY THE STATE OF THE CROPS v. THE THERMOMETER.

To the Editor of the Meteorological Magazine.

SIR,—It is certainly too much the fashion for those who report the meteorology of their respective districts to confine themselves too much to such notes as their instruments give them, and neglect those other natural indications, which are not so liable to go wrong as the best made thermometer that skill or ingenuity can contrive; in other words, it has often occurred to me that the temperature as reported in many places is very liable to give an erroneous impression as to what the heat or cold may have been; for instance, many meteorologists confine themselves to giving merely the highest and lowest readings of their respective instruments. Now, I would ask, if this be sufficient? as a sudden rise in temperature in the middle of an otherwise cold day may give a maximum much higher than it ought to be, as the warm period of that day may not perhaps be more than an hour, and such sudden rises are not unusual, and the same may be said of depressions at night. Certainly more frequent readings would obviate this to a great extent; still the whole system is artificial, and certainly not without its defects, and taken in contrast with the natural mode of indicating the average temperature of a given district in a given period of say a whole winter and a summer, as exhibits itself in the earling,

or otherwise, of some of the chief crops of the earth, not affected by artificial means ; and taking one of these as an example, let us see how it coincides with the opinion expressed of the character of the present season.

Taking it, therefore, as one of the unerring laws of nature that heat hastens on crops, and taking wheat as one occupying as extensive an area as any other, we have only to consult the farming papers to find out that the harvest has been a late one, perhaps a week later than the average in the south of England, and more than that in the north and west. Now, if we had had a hot summer this would not have been the case, *as wheat as well as all other crops is influenced by the temperature every minute during the whole twenty-four hours of every day*, whereas the meteorologist draws his conclusion simply from two especial periods of perhaps only a few minutes each—the highest and lowest points attained by his instruments ; this assuredly can have no claim to the accuracy with which nature does her work, and no mechanical contrivance involving the use of quicksilver or spirits of wine can perform the duty of registering heat and cold with such nicety as is done by Dame Nature, where the deductions to be drawn extend over a considerable period, as that of a whole season ; and taking the present one as an example, and the harvest a late one, it is evident there has been a deficiency of heat in the summer months, taking the whole of them collectively, from the 1st of May up to the end of September, for it must be observed that up to the end of April vegetation was in a forward state, but May and June being both cold months, and the heat of a certain portion of July being counter-balanced by some dull cold periods of the same month, neither the wheat nor other crops regained the position they lost in May and June. August was perhaps the finest month in the year, and September, up to 18th, was also fine, helping to ripen fruits and other late crops ; the wheat having been all secured in this neighbourhood long before this ; but as we have taken wheat as the criterion, I think it cannot be denied that it was late, and being so, the natural conclusion to be drawn from that is, that there has been a lack of heat in the aggregate, which is the cause of its lateness. Might I ask if the averages, as given by the readings of the thermometer, confirm this, taking the whole of the period from the 1st of May up to the 12th August, when the corn was mostly ripe ? and if the figures given support me in that, the period in question has been a cold one, then it may be taken for granted that the season has been a cold one, in spite of the hot periods we have had in it ; if, on the other hand, the figures indicate a contrary state of things—viz., give a degree of heat above the average of years for the same period, then it becomes us to inquire whether the artificial temperature obtained by mechanical means be the real temperature of the atmosphere, or whether some error or other has crept in. I confess having a strong predilection for giving a higher position to vegetation as a heat-indicator than is generally done by the mechanical world, for a plant is a far superior finished machine

to anything produced by the most skilful workman. The difficulty seems to be in the reading; that I fear we must be satisfied by only doing at points of time a long way apart. Say, in the matter of the wheat crop; notice when it comes into ear, and when it is ripe, and I am very much mistaken if heat, or its absence, is not exemplified here more accurately than is done by any contrivance of expanding or contracting fluids in the way of thermometers or other instruments. More might be said on this head, but enough has been given to make my views understood.

Taking another view of the past or passing season, I may add that the three months of July, August, and September, have been drier than any similar period during the last eighteen years, excepting that of 1855, 1858, 1864, and 1869, while the total rainfall of the nine months that has elapsed this year is greater than any other like period during the above time, excepting those of 1860 and 1866. 1872 has also been more prolific in thunderstorms, and I have no record for upwards of twenty years in which I have noticed such things as so late spring frosts and so early autumn ones as the present season has furnished us with; the other features of it have not been remarkable, unless it be mentioned that it has afforded sufficient diversity to enable both the weather prophets who predicted a hot season, and those who foretold a dull cold one, to claim fulfilment in both their cases. This anomalous state of matters I must leave to them to explain; at the same time if any one had foretold an unusual amount of thunder, and very late spring and very early autumn frosts, they would certainly have been nearer the mark, as far as this district is concerned, than either of the above, widely different as they are.

J. ROBSON.

THE BRITISH ASSOCIATION AT BRIGHTON.

(Continued from page 143.)

FORESTS IN THEIR RELATIONS TO HYDROLOGY.

The President introduced Monsieur G. Lemoine, Secretary of the Meteorological Society of Paris, who read a paper on this subject, drawn up in French, of which the following is an abstract:—

The action of forests on the climate of a country must be considered as extremely doubtful. In the basin of the Seine it has been established in respect to forests, as compared with soil covered with grass, or even with other permanent cultivation, that they have no influence on the watercourses. The only absolutely certain action of forests is their influence on the protection of the soil. They prevent the earth being carried away; but, from this single fact, it follows immediately that, in mountainous countries they can retard the flow of torrent waters. In fact, in the *Département des Hautes Alpes*, the presence of forests prevents the formation of torrents; the replanting of woods extinguishes torrents already existing; but in most cases turfing alone is sufficient to produce the same effect. These conclusions must be carefully limited to the countries in which they have been obtained; but they show at once the weakness and the power of man. He acts on the soil, he controls torrents; but the great general phenomena of the atmosphere, the great streams of air, which determine the climate of a country, are beyond his reach.

Dr. Brown, formerly of South Africa, said there were indications that a great portion of South Africa had been under water at one time, but at what period had not yet been ascertained. The trees varied in magnitude in different quarters,

and yet were of the same magnitude in each locality. It appeared as if these trees were the product of seed which germinated when the water-level has sunk a little below the spot on which they were growing; and if we could only ascertain the age of those trees, we might determine the period when the waters receded. Some of these trees were 70 and 80 feet in diameter, and Mr. Chapman had given him an instance of a tree 104 feet in diameter. But the dessication of the country had been going on since the draining off of the waters, owing to evaporation. The destruction of herbage and grass by fire, the use of the axe by native and colonist, and the formation of sheepwalks, had facilitated the process of evaporation. As an illustration of the effects of evaporation producing dessication, he quoted an experiment made by Mr. Wm. Blore, a Fellow of the Meteorological Society of London, and Secretary of the South African Meteorological Society, at Wynberg Hill, about eight miles from Capetown.

He sunk two cylindrical jars of the same size in the ground to the depth of four inches, leaving them projecting an inch above the surface as a precaution against sand and other matters being blown into them, and covering each with wire gauze to keep out flies, &c. The one was placed where it was partially protected, but not covered by bush, the other was sunk in a newly cleared plot of ground, measuring about 60 feet in diameter, surrounded by sugar bushes, *Protea mellifera*, *Thumberg*, of a considerable height, and otherwise protected from the prevailing wind by a belt of pine trees, about 120 feet distant.

Into each of these jars was put 20 oz. of water on January 31st, at 10 a.m. On February 5th, at 5 p.m., the water remaining in each was carefully measured, and the evaporation was calculated, when it was found that the evaporation from the jar sunk in the cleared ground had been more than double the evaporation from that which was partially protected, though not covered by the bush; the former being 1·854 in.; the latter, ·863 in.; giving an excess of ·991 in. The experiment was repeated with similar results.

In reporting these results, Mr. Blore remarked that had the experiment been made in a more arid district, the evaporation would have been greater; and that had it been made in the open country, the difference would have been marked. But taking the results obtained as the basis of calculation, he arrived, by the following process, at a conclusion, for which probably few who have not given attention to the subject, are prepared.

The excess of evaporation from the more exposed jar above that from the jar partially shaded, but not covered, being 1 in., more strictly speaking upwards of 99·100ths of an inch of water, and more than double that of the latter, "An inch in six days," says he, "will give for 102 days, the ordinary duration of the hot windy and dry season in the district, 17 in. This is equal to about 384,000 gallons per acre, and supposing 1,000 acres to be burned, blackened and dried, what with sunlight, fire, heat, and wind, the evaporation would be an excess of three hundred and eighty-four millions of gallons of water above what would have been evaporated if the bush or grass had been left unburned.

In the prosecution of his researches, Mr. Blore ascertained by experiment that on Wynberg Hill, while the deposit of dew on a green surface amounted to 4·75, that on a white surface amounted only to 2, showing that the deposit of dew upon a green surface is more than double that upon a white; and he further ascertained that while the difference of temperature in the water in the two jars employed in the former experiment was only a few degrees, the difference of temperature between black ground and ground shaded by bush was about 25°, which would occasion a vastly greater difference in the amount of evaporation than that which occurred in his experiment. He proceeded to state that humidity of air is of more importance than rainfall, and that it is not necessary, in order to account for phenomena observed, to suppose that forests attract clouds; neither is it necessary to suppose that they increase the rainfall, otherwise than they do by the repeated precipitation of the same moisture in the form of rain; that forests, whatever their effect upon the quantity of the rainfall, produce a diffusion of this both in time and space, and tend thus to diminish the frequency and the violence of thunderstorms and of torrents; that the moisture of the humid atmosphere, charged with carbonic acid and ammonia, attracted by the soil, does more to promote vegetation than would the same quantity of moisture falling as rain or applied

by irrigation ; and that the humidity of the atmosphere tended to equalize the temperature of day and night—of summer and winter.

Mr. John Ball said he did not agree with M. Lemoine in thinking that forests afforded no greater protection against the formation of torrents than pasturage, and he mentioned instances in proof which had now come under his observation.

THE RAINFALL OF SUSSEX.

Mr. F. E. Sawyer read the following paper on the Rainfall of Sussex :—

The county of Sussex is divided by the range of hills known as the South Downs, into two meteorological districts of unequal extent, and very different in their climates. In the western part of the county these hills are about ten miles distant from the sea, and they continue eastward for a distance of about forty-five miles, gradually approaching nearer to the sea, and terminating at length in the bold headland of Beachy Head. Of the two districts thus formed, the coast district, or that to the south of the Downs, has the smallest rainfall, and the air is drier, the temperature more equable, and the daily range of temperature much less than in the other district. To the east of Beachy Head all that part of the coast which is not distant from the sea more than about a mile, appears to have the same climate as that to the south of the Downs, and may, therefore, be included in the coast district. Even in this district the rainfall increases so much as we proceed further inland that it appears doubtful whether we should not consider the northern part of the coast district as an intermediate or sub-district. The second district, or that to the north of the Downs, and in the east, to the north of the coast district (generally known as the Weald) has a much greater rainfall, with extremes of temperatures and high daily range.

The causes of the increased rainfall in the Weald are threefold ; firstly, the Downs, which, rising up in the path of the rain-clouds from the coast to the Weald, attract and condense their moisture ; secondly, the woods, or the remains of the wealden forests ; and thirdly, the rivers, the beds of which form a path up which the rain storms can travel, and which also condense the vapour in their immediate vicinity.

The extreme effect of the first of these causes on the rainfall is to increase it in the Weald by about seven inches ; but although this, probably, does not extend to a distance of more than about four or five miles away from them, yet there is nevertheless a distinct increase in the rainfall at nearly all the stations in the Weald owing to this influence. Beachy Head has a great effect on the rainfall in the east part of the county, by attracting the rain-clouds from Pevensy, which decreases the rainfall there, and also by dividing the clouds into two parts, one of which passes round by Eastbourne into the Weald, the other to the westward over the Downs and also into the Weald. Hailsham, which is a few miles to the north of Beachy Head, thus escapes many showers, and its inhabitants often see the rain falling at Eastbourne whilst there is none there. The divided rain-clouds, after missing Hailsham, unite again at Heathfield.

The second of the three causes is irregular in its influence. In the time of the Romans the Weald was almost entirely covered with forests, Tilgate, Ashdown, and St. Leonard's forests being the chief remains of the ancient forests, whilst the names in other parts indicate their wooded character ;—as Hurstpierpoint, the wood of the Pierpoints (Hurst meaning wood), Midhurst, Fernhurst, Billinghurst, Ashurst, and about twenty-eight more places the names of which commence or terminate with "Hurst."

These forests are supposed to have been interspersed with lagoons, and the rainfall at this time must have been very great, as we find that several centuries after all the valley of the Adur up to Bramber, was under water. The greater portion of the wealden forests was cut down for fuel, when iron was manufactured in this county, and this fact doubtless will account for the diminished rainfall in several parts of the Weald. Trees increase the rainfall by breaking the wind and also by condensing vapour.

The third cause of increase in the wealden rainfall is slighter in its effects. Rain storms, and more particularly thunderstorms, have a great tendency to pass up river beds, and it has been observed at Brighton that thunderstorms, when two or three miles out at sea, either go wholly east or west, or else split up into two parts and go in the direction of the nearest river beds, namely, those of the

Ouse and Adur, up which they pass into the Weald. The other influence of rivers on the rainfall is by condensation of vapour. At Petworth it has been observed that about the turn of the tide, when the water begins to run up the Arun, the wind springs up, and showers frequently accompany it, and they are consequently known as "tidal winds" and "tidal showers." This phenomenon is probably caused by a cooling of the atmosphere, arising from the influx into the bed of the river of a quantity of water at a lower temperature than that of the atmosphere, which causes the air above it to contract, when the warm air on the banks rushes in to supply its place, and thus the wind currents are created, and when the condensation of vapour is very great rain follows. The greatest influence of the Downs on the rainfall is in the western part of the county. Whether this arises from the increased width of the Downs in that part, or whether the rainfall is increased by the greater breadth of land, the rain-clouds have to traverse before reaching the Downs, is uncertain. In the north-eastern part of the county there is another range of hills, known as the Forest Ridge, and these, doubtless, have some influence on the rainfall of that district. The average coast rainfall is about twenty-five to twenty-six inches, whilst that of the Weald is nearly thirty-three inches; the combination of the causes before-mentioned, however, increases this amount in some parts, whilst the absence of these influences in other parts decreases it. The wealden rainfall is then about 33 per cent. greater than that of the coast, and it is chiefly to this circumstance that its fertility is owing. The greatest rainfall occurs in the north western part of the county, and Lynch, near Midhurst, appears to be the most rainy place in the county; but as only two or three years' observations have been made there, the correct average fall cannot be ascertained, but by comparison with that of West Dean, the average is probably about 38 or 39 inches. Pevensey has the smallest rainfall in the county, as far as present observation shows; and this is owing, so the observer there says, "to the attraction by the Downs of rain clouds coming from the south-west, and by Fairlight Cliffs of rain clouds coming from the east; but it has been suggested that the rapidity with which the wind passes over this low flat part of the coast, prevents much rain from falling there. The average fall for thirty years at Pevensey was 24·07 inches." The influence of the Downs on the fall will be plainly seen by the following comparison. At West Thorney, near Emsworth, on the coast, the mean rainfall for the ten years ending 1869 was 26·87 inches, and at West Dean, which is in a valley of the Downs, it was 37·08 inches, or 38 per cent. more. At Bognor, on the coast, the mean of the ten years ending 1869 was 24·2 inches, and at Dale Park, Arundel, 33·73 inches, being 39 per cent. more. At Worthing, farther east, the mean of the last three years was 23·88 in., whilst at Steyning, in the Weald, and to the north of the Downs, the mean for the same period was 34·25 inches, or nearly 50 per cent. more. At Brighton (Buckingham-place) the mean rainfall of the last three years was 25·39 inches; and at Glynde, to the north of the Downs, it was 30·69 inches, or 20 per cent. more; and at Beachy Head the mean of three years was only 21·82 inches, whilst at Eastbourne, to the north east, it was 27·40 inches, or 26 per cent. more. The greatest rainfall which has been yet recorded in the county was in 1852, which year had the greatest rainfall of the last 150 years. In that year the total at West Dean, near Chichester, was 54·20 inches; at Dale Park, Arundel, 52·03 in.; at Chilgrove, near Chichester, 50·87 inches; and at Uckfield, 50·55 inches. The smallest amount yet registered was 13·11 inches at Pevensey in 1858. The following table gives the mean rainfall at those places where it has been longest observed:—

Chichester Infirmary.....	30 years mean, 28·27 inches.
" (Chilgrove)	" 32·95 "
Pevensey	" 24·07 "
Uckfield	28 " 29·38 "
Hastings	23 " 27·20 "
Brighton	21 " 26·20 "
Worthing	20 " 26·29 "
Arundel (Dale Park)	20 " 33·65 "
Maresfield (Forest Lodge).....	15 " 30·12 "

The monthly totals are generally very varied, but on comparing the mean monthly totals for twenty-eight years at Uckfield, and twenty-one years at Brighton, there does not appear to be much difference in the seasonal distribution, February and April having the smallest totals, whilst October has the largest.

Mean Monthly Rainfall.

	Brighton.	Uckfield.		Brighton.	Uckfield.
	in.	in.		in.	in.
January ...	2·43	2·88	July	1·94	2·34
February ...	1·44	1·68	August ...	2·00	2·51
March	1·70	1·86	September	2·68	2·78
April	1·43	1·72	October ...	3·83	4·21
May	2·05	2·22	November	2·41	2·70
June	1·80	2·01	December	2·49	2·47

The greatest amount of rainfall recorded in any month was in October, 1865, when the total at Dale Park, Arundel, was 12·23 inches ; at Uckfield, 11·23 in. ; Worthing, 10·60 inches ; and Lewes-road, Brighton, 9·59 inches. The smallest amount recorded was no rain in May, 1844, at Brighton. The heaviest falls of rain in 24 hours recorded in the county were on October 18th, 1865, 2·40 inches at Uckfield, and on the 19th 2·27 inches at West Thorney, and on September 27th, 1854, 2·38 inches at Uckfield. When the rainfall is very great, the low districts in the county become flooded. The chief places thus inundated are the levels round Pulborough, Arundel, Bramber, Beeding, Henfield, Lewes, and Pevensey. In November, 1810, these places were flooded, and at Arundel the water was seven feet deep in the levels ; in December, 1821, there was another flood, and the water was breast high on the ground floors of houses at Bramber. In January, 1828, the level at Brighton was flooded, and the rest of the county suffered much ; in December, 1839, severe floods ; also from October to December, 1841, and in February, 1847, floods were caused by the melting of snow. In the autumn of 1834 there was a severe drought in the county, which continued throughout the next winter, spring, and summer, until August, 1835. In a village near Littlehampton, cider was said to be more plentiful than water, the latter being sold at 3d. per pail. In November, 1847, the water became very low in the wells at Brighton, and in the spring of 1852, many springs were dry, which were never known to be so before. Sea salt is often contained in rain, and after the "great storm" on November 27th, 1703, salt was found on the trees fourteen or fifteen miles from the coast. A letter from John Fuller, of Sussex, dated December 6th, 1703, published in the *Philosophical Transactions* for 1704, says, "We live ten miles off the sea in a direct line, and yet can scarce persuade the country people but that the sea-water was blown thus far, or that during the tempest the rain was salt, for all the twigs of the trees the day after were white, and tasted very salt." After the severe storm of November 29th, 1836, a similar deposit of salt was seen on the windows at Lewes. The earliest rainfall observations in this county were made in 1790, by the Rev. J. Mossop, at Brighton, and published in the *Gentleman's Magazine* for 1791. No observations were then made until 1834, since which there are continuous records, and owing chiefly to the great stimulus given to rainfall observation by the Rainfall Committee of this Association, and its energetic secretary, Mr. G. J. Symons, the number of observers is now upwards of 35. There is only one rainfall proverb peculiar to this county—

"When Wolsonbury has a cap,
Hurstpierpoint will have a drap."

Wolsonbury Hill is a summit in the Downs, near Clayton, and when it is enveloped in clouds rain may be expected to fall at Hurstpierpoint. Similar proverbs exist in many hilly localities.

Mr. Glaisher corroborated the fact that the thunderstorms often become divided, and pass on both sides of Greenwich Observatory so as scarcely to be felt there.

Mr. Symons followed with some remarks further explanatory of the statements of Mr. Sawyer in his paper, and stated that the extremely exposed situation of the rain gauge at Pevensey led to the registering of less rain there than really fell.

SEPTEMBER, 1872.

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.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				inches.	inches.			in.	Dpth.	Date.	Deg.	Date.	Deg.	Date.	In shade	On grass.
I.	Camden Town	1.64	—	.62	.38	23	13	83.1	3	33.0	23	0	1
II.	Maidstone (Linton Park)	2.01	—	.21	.94	24	9	84.0	13	29.0	23	3	...
III.	Selborne (The Wakes)	2.28	—	.16	.53	24	9	75.2	2	32.0	23	1	2
III.	Hitchen .....	.69	—	1.17	.11	4	12	74.0	3	35.0	21	0	...
IV.	Banbury	1.46	—	.91	.25	1	15	76.0	3	32.0	23	1	...
IV.	Bury St. Edmunds (Culford)	2.35	+	.74	.90	25	16	75.0	3, 11	30.0	22	2	4
V.	Bridport	1.76	—	.56	.43	24	13	76.0	3	30.5	23	2	0
V.	Barnstaple	5.14	+	1.38	.92	23	25	75.0	5	35.5	23	0	...
V.	Bodmin	4.79	+	1.12	.75	23	24	71.0	7	36.0	23	0	1
VI.	Cirencester	3.05	+	.19	.80	29	9	...	...	...	...	...	...
VI.	Shifnal (Haughton Hall)	3.72	+	1.77	.85	4	21	71.0	2*	33.0	22	0	...
VI.	Tenbury (Orleton)	2.08	—	.60	.38	1	17	75.0	12	33.5	23	0	2
VII.	Leicester (Wigston)	2.28	—	.07	.41	27	16	79.0	2, 4	34.0	22†	0	...
VII.	Boston	2.19	+	.62	.57	1	20	76.5	11	37.0	23	0	3
VII.	Grimby (Killingholme)	2.76	..	..	.71	1	21	74.0	4, 12	36.0	23	0	...
VII.	Derby	2.93	+	.59	.65	1	19	74.0	4	37.0	25	0	...
VIII.	Manchester	7.04	+	3.35	1.24	1	24	75.0	5	33.5	25	0	2
IX.	York	3.63	+	1.30	.65	1	22	72.0	5	37.0	22	0	...
IX.	Skipton (Arnccliffe)	9.59	+	4.63	.86	12	28	72.0	4	31.0	20	4	...
X.	North Shields	4.79	+	3.09	.93	23	18	70.0	11	35.8	21	0	0
X.	Borrowdale (Seathwaite)	20.85	+	7.64	2.34	30	27	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...	...
XI.	Haverfordwest	5.50	+	1.79	2.04	6	23	72.2	3	38.0	29	0	...
XI.	Rhayader (Cefnfaes)	5.75	+	1.91	1.10	27	18	71.0	...	35.0	...	...	...
XI.	Llandudno	6.83	+	4.49	1.40	1	22	79.6	4	43.6	24	...	...
XII.	Dumfries	4.71	+	1.98	.69	27	24	...	...	...	...	...	...
XII.	Hawick (Silverbut Hall)	3.84	...	...	.68	2	25	...	...	...	...	...	...
XIV.	Ayr (Auchendrane House)	9.84	+	6.11	1.18	6	22	72.0	4	30.0	25	2	3
XV.	Castle Toward	8.39	+	3.77	1.35	12	21	71.0	3	...	...	...	...
XVI.	Leven (Nookton)	3.92	+	1.44	.50	7	22	67.0	5, 11	33.0	20\$	0	6
XVI.	Stirling (Deanston)	7.11	+	3.96	.94	30	21	66.9	4	29.8	24	3	6
XVI.	Logierait	4.79	...	...	.68	1	24	66.0	11†	33.0	23	0	...
XVII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...	...
XVII.	Aberdeen	6.96	...	...	2.16	25	26	65.7	6	37.8	23	0	8
XVIII.	Inverness (Culloden)	3.76	...	...	.54	23	27	62.7	12	38.6	23	0	6
XVIII.	Portree	11.02	+	.25	1.54	27	29	...	...	...	...	...	...
XVIII.	Loch Broom	6.90	...	...	1.52	28	26	...	...	...	...	...	...
XIX.	Helmsdale	3.50	...	...	.71	3	23	...	...	...	...	...	...
XIX.	Sandwick	3.50	—	.16	.63	5	25	60.8	5	39.0	22	0	4
XX.	Cork	4.24	...	...	1.20	2	10	...	...	...	...	...	...
XX.	Waterford	3.20	+	.07	.82	9	18	73.0	13	37.0	26	0	...
XX.	Killaloe	4.60	+	.44	.70	26	26	77.0	13	38.0	26	0	1
XXI.	Portarlington	2.59	—	.69	.35	5	27	74.5	13	35.5	21	0	...
XXI.	Monkstown	2.38	+	.39	.52	5	19	...	...	...	...	...	...
XXII.	Galway	6.90	...	...	1.03	5	20	67.0	13	32.0	4||	3	...
XXII.	Bunninadden (Doo Castle)	6.96	•	...	.72	2	27	...	...	...	...	...	...
XXIII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Waringstown	4.88	...	...	.60	2	25	75.0	14	35.0	24	0	1
XXIII.	Strabane (Leckpatrick)	7.22	..	...	.63	11	29	...	...	...	...	...	...

* And 3, 4, 13. †And 15. ‡And 24. §And 22. ||And 15, 19.

†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.

LINTON PARK.—First 18 days warm and fine, then cold set in, with sharp frosts on 20th, 21st, and 22nd; Heavy R on the 24th; L on the evening of the 19th; high wind on the 27th; bar. unsteady from the 18th to the end of the month; winds mostly W. and S.W.; on the whole a fine month, the middle part of it very dry; only .06 of R falling from 5th to 23rd; temp. about the average; rainfall below it.

SELBORNE.—A gorgeous sunset on the 2nd, followed by R at 9 p.m. On 3rd, T occasionally, TS and violent R at 11 p.m.; L, T, and heavy R at 6 p.m. on 4th; violent wind on 26th and 27th, from N. and N.W.; prevailing winds S.W. and W. An exceeding windy month, but on the whole favorable harvest weather; crops below the average, but well got in; the largest crop of hops known for many years.

BANBURY.—T and L at 3 a.m. on 4th; H at 0.30 p.m. on 21st; high wind on 26th and 27th.

CULFORD.—T on 3rd, 4th, and 29th; heavy fall of R on 25th, amounting to .90 in.; a very sudden and remarkable depression of temp. took place on the 19th, and continued during the three following days; on the night of the 22nd, at four feet from the ground the ther. registered 30°, while that on the grass went down to 26°, and many plants which are usually expected to resist 8° or 10° of frost, were found to be much injured, this injury from frost does not appear to have been general, as in localities only a mile or two from this station the same species of plants are uninjured, although the sudden change of temp. appears to have been universally felt.

BRIDPORT.—T and L on 3rd, 4th, and 24th; on 4th a very heavy TS from 6.30 to 7.15 p.m.; T very loud, and L very vivid and forked.

SHIFNAL.—To the 11th a copious daily rainfall, except on 5th and 8th; a cessation till 17th, when it set in again, and fell daily to the end, except on 22nd, 28th, and 30th; TS from S.W. at 5.30 p.m. on 4th, and again from S.E. at 4 p.m. on 21st, with H, which fell heavily with large stones not far off, especially at Shrewsbury; up to the 20th the temp. was warm, on that day a sudden and remarkable change came on, for some days max. 52°, 50°, 51°, 50°, 50°, and 52°, respectively, when it rose again above 55° to the end of the month; on the nights of the 21st and 22nd the tender plants were cut down; the wind, which began from S.E. changed on the 7th to S.W., and varied from that to N.W. to the end; heavy gales from S.W. on 27th and 28th; partridges very scarce, drowned in the egg or while young by the thunder-showers; many Red Admiral butterflies, and several Camberwell Beauties seen here. Few damsons, nuts, or walnuts; blackberries abound, but not a mushroom has yet appeared.

ORLETON.—Very warm, but generally cloudy, with frequent R till the 10th, then dry and warm but cloudy, to the 17th, when the wind and temp. changed, and the remainder of the month was very cold, with rough winds; frost on the mornings of the 23rd and 24th; TS on 4th; T heard on 3rd; L seen 3rd, 4th, 23rd, and 24th; H on 19th and 21st, and rough winds on 25th, 26th, 27th, and 28th.

WIGSTON.—T on 3rd and 4th; T, with H and S on 21st, and with H on 29th; very stormy on 25th and 27th.

GRIMSBY.—T, L, R, and squalls at 1.30 p.m., and again at 9.30 p.m. on 4th, and the night hot; a little S fell on the 20th, and H on 21st; wind high on 25th, 27th and 28th; max. temp. only 49° on 24th; harvest finished by the middle of of the month; less gossamer than usual; many red admiral butterflies.

MANCHESTER.—TSS on 4th, 6th, 9th, and 29th; H and sleet on 21st.

YORK.—S in the morning of the 21st in the neighbourhood; gale on 27th; heavy H storm on 28th.

ARNcliffe.—TS on 3rd; very wet and dark from 9th to 13th; high flood on 27th.

N. SHIELDS.—TSS on 3rd and 4th; stormy, with H on 24th.

SEATHWAITE.—T on 3rd, 5th, and 29th; H on 28th; the rainfall of 9th, 10th, 11th, 12th, and 13th (5 days), amount to more than 7 in. in the five consecutive days, and upward of 6½ in. fell from the 27th to the end of the month, though the fall on the 29th was only .27.

W A L E S.

HAVERFORDWEST.—A very wet month, scarcely 24 hours dry, consequently great difficulty in saving the late harvest; very stormy at times, particularly about the 5th and 6th; from the 24th to the 27th, accompanied by L and H; very bleak and cold during the last week; general health very good; an entire absence of zymotic disease.

CEFNFAES.—The month damp and cold for the season; wind S., S.W. and N.W.; TSS, with H, slight frosts at night.

LLANDUDNO.—On 3rd T at 4 a.m., and from 11 p.m. to 1.30 a.m. on 4th; a short and sharp TS at 3 p.m. on 9th; TS, with H on 21st; the commencement of the month the air full of electricity, either aurora or sheet L nearly every night; the latter part of the month the equinoctial gales more frequent and higher than usual; S on the distant hills on the 21st and 22nd; On the morning of the 20th, about 7 a.m., a beautiful waterspout (which travelled rapidly from N.W. to S.E.) was seen in the bay.

S C O T L A N D.

DUMFRIES.—The first half of the month wet, and most unfavourable for the harvest, the temp. being high caused much sprouting of grain; a few dry days after the middle of the month, and a good deal was secured in better condition than was expected; the close of the month wet; potatoe crop much diseased; T on 3rd and 4th.

HAWICK.—A remarkably wet and stormy month; much T and L on 3rd, 4th, and 5th; slight frost on the night of 20th; potatoes more than three-parts lost by disease; turnip crop looking well; cereals much injured by the heavy rains, and much standing in stooks, which cannot be got in from the almost incessant rain.

AUCHENDRANE.—TSS on 3rd, 4th, 5th, and 7th; wind, rain, and cloud above the average for September; evaporation below it; with so great an excess of rain the crops have of course suffered severely, and the rivers have been in high flood.

CASTLE TOWARD.—Only one fine day from the 2nd to the 20th; TSS on the 5th and 28th; high wind on 28th; harvest operations being rapidly pushed forward, every available minute taken advantage of notwithstanding the backwardness of the season; potatoe crops getting worse every day, and all hope is gone regarding them.

DEANSTON.—The wettest September for 34 years; some frosty nights; stormy on 25th and 28th, with T and L on the latter day; some corn still not gathered, potatoe crop much diseased.

LOGIERAIT.—Very wet month, only 9 dry days since 21st August; harvest greatly retarded, and part of the crop is still unsecured; potatoe disease very severe; tops of hill covered with S on 21st.

ABERDEEN.—A dull and wet month, with low day temperature; latter part of the month stormy; much S in the country districts during the last ten days; grain crops much injured, a great deal is still uncut; TS at noon on 3rd, and from 8.30 to 10.30 a.m. on the 4th; fog on five days; H on 20th, and sleet on 22nd; more than 2.00 in. of rain fell on the 25th, and the streams were much flooded.

PORTREE.—A wet and stormy month; fog on 6th, 7th, and 13th; TS from 10 p.m. on 27th to 8 a.m. on 28th; from 1.30 to 1.55 a.m. of 28th the L was incessant and vivid, and the storm was the worst ever remembered; heavy gales from the N. on 25th; the crops are in a very backward condition, not a stook in the stackyard yet, and about two-thirds of the potatoes are diseased; cattle and sheep in good condition, and sell at high prices.

LOCHBROOM.—A ruinous month for the agriculturist, only four days without rain, and they were murky; crops cut six weeks ago are still out; our greatest arable farmer has not housed a single stook, the rain began just as they were going to cart it at the beginning of the month, and not a dry day have they had since, and October has begun with a terrible flood; potatoes stand wonderfully.

SANDWICK.—T on 4th and 5th ; lunar rainbow on 19th ; H on 21st ; frequent auroræ ; the month 2°·3 colder than the mean of the previous 45 years, this was owing to the northerly winds which prevailed on and after the 18th, which though disagreeable to people in general was very acceptable to the farmer, as it prevented the wet grain from sprouting.

I R E L A N D.

DOO CASTLE.—Floods the order of the day ; oats and hay, particularly the latter, are almost beyond recall, there are not a dozen stacks of corn made within a radius of three miles, and the late cut meadows are entirely lost. Potatoe crop poor and much diseased ; the people are in despair, and well they may, another such a year and famine would walk through the land.

WARINGSTOWN.—More rain has fallen this month than during any other this year by '78 ; the crops are suffering much from the constant rain.

LECKPATRICK.—Wettest September ever registered here.

BOOKS RECEIVED.

Fourth Report of the Underground Temperature Committee. [From the *Brit. Ass. Report.*] 8vo.

On the connexion between Explosions in Collieries and Weather. By R. H. SCOTT, M.A., F.R.S., and W. GALLOWAY. [From *Proc. Roy. Soc.*] 8vo.

On the General Circulation and Distribution of the Atmosphere. By Prof. J. D. EVERETT. [From the *Phil. Mag.*] 8vo.

Meteorological Tables, &c., Truro, 1871. By C. BARHAM, M.D. [From *Journal of Royal Institution of Cornwall.*] 8vo.

Climate of Sidmouth, with results of Met. Obs., 1865-1870. By J. I. MACKENZIE, M.B. Cantab. [Reprint from *British Medical Journal.*] 8vo. Richards, Great Queen Street, London.

Sussex County Lunatic Asylum Reports, 1868-69, 1870 and 1871. 8vo.

St. Swithin and other Weather Saints. By Rev. L. JENYNS, M.A. [From *Proc. of the Bath Nat. Hist. and Antiquarian Field Club.*] 8vo. "Chronicle" Office, Bath.

Meteorological Observations, Toronto, January to June, 1872. By G. T. KINGSTON, M.A., Director.

A contribution to our knowledge of Atmospheric Waves. By W. R. BIRT, F.R.A.S., F.M.S. [From *Phil. Mag.*] 8vo, 14pp.

A Puzzle in Rain, and an attempt to solve it. By GEORGE F. BURDER, M.D., F.M.S. [From *Proc. of Bristol Naturalists' Society.*] 8vo, 7pp.

Note sur l'état probable des eaux courantes du bassin de la Seine dans l'été et l'automne de 1870. Par M. E. BELGRAND, Inspecteur-General, et G. LEMOINE, Ingénieur des Ponts et Chaussées. Paris : Dunod, Quai des Augustins. [Extrait des *Annales des Ponts et Chaussées.* T. XIX., 1870. 8vo, 15pp.

Sur les variations du mode de répartition de la pluie entre les différentes époques de l'année pour une même région. Par M. G. LEMOINE. [Extrait de l'*Annuaire de la Société Météorologique de France.* Tome XVII.] Large 8vo, 12pp.

Ponts et Chaussées, Service hydrométrique du bassin de la Seine. Résumé des observations centralisées pendant les années 1869 et 1870. Par M. G. LEMOINE. [Extrait de l'*Annuaire de la Société Météorologique de France.* Tome XIX.

Inaugural Address. By A. BUCHAN, M.A., F.R.S.E., as President of the Botanical Society of Edinburgh. 8vo, 15pp.

Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the Year 1869, under the superintendence of the Rev. ROBERT MAIN, M.A., Radcliffe Observer. Large 8vo, 72pp. Oxford : J. Parker and Co.

Report of the Meteorological Committee of the Royal Society, for the year ending December 31st, 1871. 8vo, 72pp., 1 plate. Eyre and Spottiswoode.

Quarterly Weather Report. 1871. Part I. Jan.-March. [Published by authority of the Meteorological Committee.] 4to, 86pp. 18 plates. Stanford.

A Discussion of the Meteorology of the part of the Atlantic lying North of 30° N., for the eleven days ending February 8th, 1870, by means of Synoptic Charts, Diagrams, and extracts from Logs, with Remarks and Conclusions. [Published by the authority of the Meteorological Committee.] 4to, 164pp., 20 plates. Stanford.

S Y M O N S'S

MONTHLY

METEOROLOGICAL MAGAZINE.

LXXXII.]

NOVEMBER, 1872.

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EXCESSIVE RAINS IN OCTOBER.

Although it is yet too early to pronounce decisively on the characteristics of the rainfall of October, 1872—the following table and notes will show that it has been, in several respects, unusual.

Station.	County.	October.		Jan.-Oct. inclusive	
		Amount inches.	Per cent. of average	Amount. inches.	Per cent. of average
Camden Square, London	Middlesex	5·20	218	25·53	119
Tanfield Lodge, Croydon	Surrey	5·43	207	28·57	130
Kew Observatory.....	"	4·32	200	20·30	102
Linton Park, Maidstone.....	Kent	4·48	163	28·03	125
Uckfield	Sussex	5·03	133	25·89	102
Selborne	Hampshire	6·81	188	37·17	132
Long Wittenham, Abingdon...	Berkshire	2·94	104	23·67	102
Berkhampstead	Hertfordshire	4·75	185	29·57	121
Hitchin	"	3·73	165	22·51	111
Banbury	Oxford	3·45	149	26·46	121
Culford, Bury St. Edmunds ..	Suffolk	3·12	126	26·80	132
Bridport	Dorset	6·76	196	33·24	128
Broadhembury, Honiton	Devon	5·86	163	37·30	132
Bodmin.....	Cornwall	8·10	156	54·54	146
Cirencester	Gloucester	3·65	117	32·98	122
Haughton Hall, Shifnal	Shropshire	6·07	276	37·14	178
Orleton, Tenbury.....	Worcester	4·52	153	34·88	135
Wigston	Leicester	3·72	156	32·54	154
Derby	Derby.....	4·56	166	33·08	146
Manchester	Lancashire.....	4·40	119	43·97	156
Bolton	"	5·32	94	48·64	124
York	York	3·94	177	31·91	158
Arncliffe, Skipton	"	7·28	121	62·78	132
North Shields	Northumberland.....	5·96	220	32·32	152
Seathwaite	Cumberland	19·13	128	143·04	120
Haverfordwest	Pembroke	7·93	154	51·08	131
Llandudno	Carnarvon	8·17	226	38·57	156
Guernsey	Guernsey	11·98	300	42·18	146
Dumfries	Dumfries	4·61	112	41·09	136
Nookton, Leven	Fife	3·58	117	35·97	151
Deanston	Perth	3·43	77	45·06	125

The averages with which the above values are compared are those of
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the same stations during the ten years, 1860-69, which are at present the longest and most uniform series available.

It appears that the excess has been greatest in the three following isolated localities, Guernsey, Shifnal, Shropshire, and in Northumberland. We have still sadly too few stations in the vicinity of the Scottish borders, but the following indicates that in that district the excess has been very considerable.

Station.	Fall in October. in.		Average in October, 1863-71. in.		October per cent of 9 year average.
North Shields	5·96	.....	3·07	.. ..	194
Howick.....	6·85	.....	3·12	.....	220
Middleton	7·07	.....	2·95	.....	240

In the above the average, 1863-71, is used instead of 1860-69, because neither at Howick nor Middleton were trustworthy observations made before 1863. It will be seen that the North Shields average, 1863-71, is higher than that for 1860-69, and therefore, probably, the same is the case at Howick and Middleton, thus showing a gradual increase in the excess as we approach Berwick, where unfortunately we have no correspondent. On the other side of the Border it again decreases, being 5·56 in. at Melrose, and only 3·08 at Edinburgh. On the Western coasts the fall though large (at several stations it exceeded 15 inches) has not been much in excess, but Broughton in Furness had a remarkable fall on the 7th, of 3·01 whereof 2·93 in. fell in 14 hours, producing a great flood in the Duddon.

REMARKS BY EARL GREY ON THE RAINFALL OF OCTOBER 10TH AND 11TH, AT HOWICK, NORTHUMBERLAND.

This was the heaviest fall of rain there has been for 20 years. The 10th was a beautiful morning but it clouded over between 1 and 2 p.m., and about 3 o'clock extraordinary thick and black clouds came up from the sea, with a light air from the S.E. It became almost dark and began raining about 3.40—at first the rain was not at all heavy, but in about half an hour became exceedingly so and the wind suddenly chopped round to the N.W. blowing strong, and before bed-time it had increased to a heavy gale, varying from N.W. to North, the rain continuing with scarcely any intermission till the following afternoon, when it became much more moderate, and there were several fair intervals. There was, however, more or less rain during the night. Between 3.40 p.m. on the 10th, when the rain began, and 9 a.m. of the 12th, 2.96 of rain had fallen, of which somewhat less than half an inch fell after 3 p.m. on the 11th, so that about $2\frac{1}{2}$ inches had fallen in 24 hours. The worst of the storm seems to have been just about this place. There was considerably less rain, according to the account published in the *Times*, at North Shields less than 40 miles to the South, and much less at Ford Castle, 30 miles to the N.W.

NORTH SUNDERLAND, 3 p.m. Oct. 11th 1872.—SIR, I have to-day recorded the heaviest fall registered since I began to observe; it may interest you. After a fine morning yesterday, S.S.W., the wind

backed to S. and S.E., till about 5 p.m. when it began to rain; wind continued backing to E. and E.N.E. till 10 p.m. when the wind freshened and rain fell heavily; continued to back to N. till about midnight, from which time we had a furious gale and very heavy rain all night, the rainfall measured at 9 a.m. to-day being 1·61 for 16 hours. Storm still continues at 3 p.m. with only slight abatement at intervals but rain not so heavy. Barometer continuously falling (with two slight rises on 7th and 9th) since the 5th p.m. from 30·14 to 29·01—to day rising but slowly, the wind working to the West and just now N.W.—OCT. 12TH, 1872. Storm continued all last night, and to-day (though with some abatement) from N.W., to N.N.W. Rainfall for the 24 hours taken at 9 a.m. to-day, 1·28: barometer slowly recovering at 9 a.m., 29·27—3 p.m. 29·33. Less rain fallen to-day, but gale still high and much sea on; more land flooded than for 30 years.—F. R. SIMPSON.

THUNDERSTORM AT WINCHMORE HILL.

To the Editor of the Meteorological Magazine.

SIR,—A violent thunderstorm passed over this neighbourhood to-day; thunder was first heard in S. at 11.15 a.m.—11.35. Heavy thunder in S.S.W. 0.45 p.m.—Violent thunderstorm, lightning intensely vivid; right overhead from 0.49 to 0.55 p.m. The storm abated at 1.15 p.m., thunder ceased at 2 p.m. Heavy splashes of rain from 12 noon to 12.20 p.m., amount gauged ·18in.; the rainfall to the N. and E. was very heavy and accompanied by hailstones of immense size. No hail fell here. A telegraph post at Edmonton was struck by lightning.—Yours truly,

THOS. PAULIN.

Winchmore Hill, 3rd October, 1872.

DECREASE OF RAINFALL WITH ELEVATION.

To the Editor of the Meteorological Magazine.

SIR,—Will you kindly allow me to ask those of your correspondents, who have for months past so ably discussed this subject, why it is that the point in question being simply, "The Cause of the Decrease of Rainfall with Elevation," they have not, in the first instance, given more attention to those cases, exceptional though they may be, in which the elevated gauge and the gauge placed near the ground, receive the same shower under circumstances as nearly similar as it is possible, with our present knowledge to obtain them, viz., during the absence of that great disturbing element and sure fore-runner of endless complications—the wind. I refer more particularly to those instances in which a heavy rainfall occurs during a perfectly calm state of the atmosphere.—I remain, Sir, yours truly,

EDWD. MAWLEY.

Addiscombe, Croydon, 10th Oct., 1872.

CORRECTIONS FOR DAILY RANGE.

To the Editor of the Meteorological Magazine.

SIR,—It has long been doubtful with me how far observers in distant parts of England from Greenwich are doing right in reducing their thermometer observations, made at the hours of say 9 or 10 o'clock, by the table of reductions given by Drew in his "Practical Meteorology," p.p. 63, 169, to bring the observed to the true readings. I have given up the correction applicable to the maximum and minimum observations, see above p. 72., as wisely suggested by the Scottish Meteorological Society, but, as I conclude *both* tables, viz: for the correction of the wet and dry bulbs, *and* the maximum and minimum Thermometer readings are deduced from the observations made at Greenwich, I should, with your permission, wish to ascertain the judgment of the readers of the magazine as to whether it is not desirable to *discontinue* (or ascertain some sufficient reason for continuing) the application of the usual correction to the wet and dry bulb thermometers also. Reductions may be suitable and true for Greenwich, no doubt are so, and perhaps the neighbourhood of London generally, yet can hardly I consider be consistent for Gloucestershire or Yorkshire.—Believe me, faithfully yours,

WILLIAM L. W. EYRE.

*Huntley, Gloucester, Oct. 22, 1872.*HEAT AS INDICATED BY THE STATE OF THE CROPS
v. THE THERMOMETER.*To the Editor of the Meteorological Magazine.*

SIR,—In your last number there appeared a letter on the above subject from Mr. Robson. Allow me to call attention to several apparent errors and omissions with regard to it: (1) the writer says (alluding especially to wheat), "that heat hastens on crops," but omits to state that excessive moisture retards wheat, however considerable the warmth that accompanies or follows that moisture. In 1844 the mean temperature of the period from the 1st May to 12th August (the period Mr. Robson refers to in his letter), was $58^{\circ}3$. In 1864, the mean of the corresponding period was also exactly $58^{\circ}3$. In the present year the mean of the same period was $58^{\circ}4$, that is about $0^{\circ}5$ above the average of 101 years. The former seasons being very dry gave us good and early harvests; the latter period (1872) although slightly ($0^{\circ}1$) warmer than those of 1844 and 1864, gave us an indifferent and somewhat late harvest in consequence of the superabundance of wet. The heat being about the same in each of these three periods the difference in the commencement of harvest is, I think, clearly not to be attributed to temperature. In 1864 the summer was remarkably dry, but by no means remarkably warm in the early part. If your readers will refer to *British Rainfall* for 1864, they will see that your Linton Park correspondent speaks of June of that year as "often cold" after the first week, and the following month as "very dry, bright sun, with drying winds," but does not call it a hot or even a warm July. On the same page your Taunton correspondent says

"harvest has commenced generally." So the harvest began as early as July, in 1864, notwithstanding the "cold" weather of June and the absence of any particular heat in July. We may, therefore, conclude that the early maturity of wheat indicates the previous prevalence of dry weather as much or more than it does that of shade heat. We may also conclude that the failure of the wheat plant to correspond in its progressive stages with the heat of the past season is to be attributed to the retarding influence of excessive moisture, especially in May, and considerable portions of June and July. (2.) Mr. Robson calls May a summer month. That it most certainly is not, as a rule. Luke Howard, the father of British Meteorology, in his work on the *Climate of London*, Vol. I., p. 247, says, "Summer begins the 7th June and lasts ninety-three days," that is to the 7th of September. This year the summer commenced a few days after the 7th of June, and lasted ninety-seven days. (3.) June of this year was not a cold month after the 12th, for, after that date, there were only five days when the mean temperature was below the average at Greenwich. (4.) Mr. Robson says, "the heat of a portion of July was counterbalanced by some dull cold periods of the same month." This was not the case at Greenwich. At that observatory the warm days were to the cool ones as two to one, there having been twenty-one days when the mean temperature was in excess and only ten days when it was in defect. The mean of the whole month was $65^{\circ}0$, which is $3^{\circ}6$ above the average of 101 years. Mr. Robson may think that these figures do not express with absolute accuracy the heat of last July; but surely the Greenwich method of determining the mean temperature of the month is better than merely guessing that one portion of it was "counterbalanced" by another, as Mr. Robson appears to have done. If that gentleman will kindly take the trouble to compare the mean temperature of last July with the mean of the same month for eighteen years past, I believe he will find that last July at Linton was about one degree above the average. An average of six or seven years past would not be sufficient to compare it with, because July has so often been unusually hot since 1864. I know Mr. Robson's table extends seventeen or eighteen years back, because in your Magazine for March last (p. 32) he gives his mean temperature for February, 1855. So if I am wrong in my belief that July last was considerably warmer than the seventeen or eighteen year average at Linton, Mr. Robson can easily prove me to be so by producing the figures asked for. (5.) Your correspondent also says, "the meteorologist draws his conclusion simply from two especial periods of perhaps only a few minutes each—the highest and lowest points attained by his instruments." Now, it ought in fairness to be stated that the Greenwich daily means are not obtained in this way; they are determined from a number of observations sufficient to give the true mean of the whole twenty-four hours. According to these reliable means last summer was remarkably hot. The mean temperature of the three months of summer, from the middle of June to the middle of September, was about three degrees above the average of 101 years. It

was *hotter than any other three months* in the last fifty-eight years, excepting in 1818, 1826, 1846, 1857, 1859, and 1868, and in the periods between these years there was no summer anything like so hot. It appears then that as the wheat plant is seriously affected by drought and rainfall (and I might add blight), it cannot indicate the warmth of summer so well as the thermometer, which is not so affected.

GEORGE D. BRUMHAM.

31st October, 1872.

To the Editor of the Meteorological Magazine.

SIR,—I have read the article on “Heat as indicated by the state of the crops” &c., on pp. 158–60 of your Magazine for the current year, and would like to point out (1) that the writer of the article, after stating in effect that the present system of registering heat and cold is defective and unreliable, wishes (p. 159, line 35) to call in that very system to confirm his theory; and (2) that, although evidently willing to abide by the result if confirmatory, practically refuses (line 41) to give heed to it if contradictory.—I remain, Sir, truly yours,

E. G. ALDRIDGE.

3, Bonny-street, Camden-road, 18th Oct., 1872.

P.S.—I may state that, in my humble opinion, plants, being much affected by rain, blight, &c., as well as by heat and cold, will prove very poor thermometers.

DISTRIBUTION OF RAIN OVER THE BRITISH ISLANDS IN SEPTEMBER, 1872.

In the month of August we went into considerable detail in describing the conditions under which the various falls of rain were produced in our islands. In the present and future months the remarks will be more brief, but it is hoped that at the end of the year some general conclusions may be arrived at of value to all who study meteorology.

On the 1st, southerly winds being present in England and Ireland, with northerly and north-westerly breezes in Scotland, we find rain throughout the two former countries, but very little in the north of Scotland. The next day the Scotch winds drew into east, forming part of the general circulation round some disturbance in the north-west, and immediately we find the heaviest rains on the north coasts, while in the south the weather became finer. On the 3rd and 4th thunderstorms, with variable winds, were the prominent features. The rains were general but variable in intensity. For some days after this a series of depressions passed over us; the first which crossed our islands between the 5th and 7th, produced wet weather in the west and north on the 5th. As its centre crossed to the southward of the Scotch stations, most of the Scotch reports showed very little rain on the 6th; but on the 7th the north-west wind in the rear of the depression brought a little. In addition to this, a slight south-westerly breeze at our southern stations gave about 0·03 in. along our channel coast. On the 9th a new depression crossed Scotland from west to east, giving us rain on all our coasts. The 10th showed another in the

north-west, which, as it passed, brought rain, except to the south-east, on the 10th and 11th. The path of the next depression lay considerably to the north of us, and, consequently, the rain which it produced on the 12th and 13th was confined to our western and northern coasts, while on the 14th only slight showers were reported. The 15th and 16th brought a slight disturbance, and showers to the extreme western and northern districts; but on the 17th and 18th as a small bourasque crossed Scotland the falls of rain extended to all but our southern stations, and, in addition, a slight disturbance in France was accompanied by showers on the French coasts. For a time the passage of definite depressions over the United Kingdom ceased, and northerly winds became general. The northerly current was, however, more or less interrupted on the 19th and 20th by thunderstorms, with showers; and on the 21st, as it increased in strength to a gale in the west, the showers increased, and even snow fell in some places. On the 22nd a local depression showed itself in the north of England, reversing temporarily the direction of wind in England, and producing a general rain in the north-west and north. The 23rd found the depression over the North Sea, but several slight disturbances over our islands, from a great intermingling of the south-west and north-west winds, produced rain throughout the north-west of Europe. The 24th gave thunderstorms, with very variable amounts of rain; while on the 25th the northerly current being then restored in great strength, *very* heavy rains were reported all along the east coast of Great Britain, and some in central Britain. At this time the passage of depressions from west to east across our islands was resumed, and continued till the end of the month; these gave us a great deal of rain, especially in the west and north.

Thus we see that the excess of rain at the west and northern stations appears to be owing to the extension over them of several depressions whose influence was not felt in the south and east. Even the bad weather of the 25th, which produced so much rain on our *east* coasts, was still more severely felt in the east of Scotland.

F. G.

DAILY VARIATIONS IN THE PREVALENCE OF RAIN DURING OCTOBER, 1872.

THE month of October has been marked by the passage over us of a series of depressions, travelling chiefly in an easterly or a north-easterly direction. Some of these just skirted the west coast of Ireland and north-west of Scotland; others crossed over the centre of our islands, while many were accompanied by additional local disturbances, which brought much rain to the neighbourhoods near which they passed. One depression (17th to 19th) travelled slowly in a north-westerly direction; and another, which once disappeared over France, *apparently* formed again subsequently.

The first wind system by which we were affected had shown itself on our north-west coasts on the 30th September, when it brought a

considerable quantity of rain to the west and north of the kingdom. During the 1st and 2nd the disturbed weather spread over the whole of north-western Europe, while its centre travelled slowly eastwards to the northward of the Scotch coasts, the rain in the north diminishing in quantity as the wind drew into west. During the 3rd and 4th, however, a local depression crossed to the southern central parts of England, and while the weather dried up in the north-east rain returned to the western and southern districts, with thunder and lightning in several places. Some snow and hail fell in the north, with a northerly breeze. The next general disturbance began on the 6th, manifesting itself first, as before, to the north-westward of Scotland, and bringing rain to the western and northern stations. For the next two days the wet weather extended gradually to all parts of our islands, and large quantities fell in the west and north-west. On the 8th the disturbance was supplemented by a slight local depression crossing the south of Ireland and centre of England in an easterly direction, but as it passed off leaving finer weather in its rear. The change was, however, only temporary, for the night of the 9th brought a new storm to the west coast of Ireland, which travelled east-north-eastwards, and at 8 a.m., 11th, had its centre over the North Sea. Ireland first felt the rain, but during the 10th all parts of north-western Europe were involved in the downpour. Even our north-east coasts, which had the northerly winds, came in for a large quantity, 1.65 in. falling at Shields in the twenty-four hours, and 1.14 in. at Aberdeen next day. As the bourasque passed towards Denmark on the 11th and 12th, the weather continued showery, with thunder and lightning in several places, and heavy rain in the west of France. The 13th was rather finer generally; the 14th very much so, though still showery in Ireland. The 15th brought fresh disturbances and rain, a well-defined but local depression showing itself over our southern counties by 8 a.m. 16th, in addition to a larger but shallower one lying between the Scotch and Norwegian coasts. These quickly gave way to low pressures in the Bay of Biscay on the 17th, which travelled to the entrance of the English channel by the following morning, and then north-westwards to the south of Ireland. In this manner rain continued in Great Britain, and returned to Ireland on the 18th, after a temporary absence during the north-easterly winds of the 17th. With the exception of some showers locally the 19th was finer, but on the 20th pressure became comparatively low in a band lying from south-west to north-east over the British isles, the north of France, and the North Sea, and two shallow depressions formed in the south of England. Wet weather again returned, to be continued on the following day by a new and more serious disturbance in Scotland. On the 22nd this gradually passed off; but night time brought a new fall of pressure to our western stations, which, together with rainy weather, spread eastwards, till on the 24th and 25th rain fell in all parts of the country. With a general rise of the barometer this bourasque disappeared late on the 26th, and a fresh but slight depression appeared in the north-west of Scotland, and

travelled eastwards, thus keeping the atmosphere in a damp and unsettled condition generally. What is more strange, however, is that the southern depression re-appeared over France in the night of the 27th, causing the wind at our southern stations to return to the northward and north-eastward, with rain again, while finer weather visited the northern parts of the country. From late on the 28th till the end of the month a very large depression passed over us, bringing a return of southerly and westwardly winds to all our coasts, with very much rain, commencing in the west and north on the 28th. In this disturbance the barometer fell as low as 28·6 in. in the west of Norway, and no less than five inches of rain fell at Seathwaite on the 29th.

F. G.

REMARKABLE COMPLEX FLASH OF LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—I do not see anything complex in the very lucid description of the effects of a flash of lightning at Lynwood, by Admiral the Hon. Sir F. W. Grey, on the 13th July. Any one who has been in a thunder-storm must know that the concussion in the air by a flash of lightning that reaches the earth, is much greater than that of any great gun when fired. The gallant admiral must be far better acquainted with the fact than I am, though he may never have been closer than I have been to the flash, and it is quite possible that he made no comparison of it with the effects of that with which he was so familiar. Your own remarks in your October number show that though you notice the “expansion of air or steam inside” the greenhouse, in your opinion there were “ramifications of this flash,” affecting objects in “an area of 315 by 146 ft.” From many and close observations of the effects of electricity I am inclined to think that the conductor on the chimney, 52 ft. high, had nothing to do with it, but that the water or the metal in the greenhouse attracted the “bright double flash,” with a single discharge “like that of a gun.”* Taking the greenhouse as the centre, the trees that were injured form points in the diameters of circles, the longest radius being about 250 ft. We know that windows of houses are broken by the concussion of guns fired at much greater distances than this, and we must remember that in the month of July the bark of trees is easily removed. The effect of these concussions on trees is remarkable; as far as I have been allowed to examine the subject, a violent deflection of the tree takes place, and, as it returns, the bark is thrown off with violence. This action would account for some of the bark of *r* being found inside the greenhouse, while the fact of its being there goes to prove the cause. The deflection of the tree was *from* the centre of concussion in the greenhouse, the recoil of the tree and the scattering of the bark was therefore *towards* the greenhouse. I have seen the bark of trees scattered to greater distances, while the ply of the tree necessarily removes the earth more or less around the

* All electric discharges when close to us sound as one explosion; it is, I believe, the reverberation that makes the rolling thunder.

roots. There is one more proof of the correctness of this interpretation: the tree F was more injured than the other four, simply because it was nearest to the concussion centre. While explaining this case from cases which I have seen, I do not deny the possibility of one flash spreading sufficiently to do the whole damage instantaneously, but in this case I think that scorching of the trees would have been noticed by observers, who even remarked that the red lead on the joints had been "disturbed," and that the force of the explosion apparently acted "outwards" from the interior of the pipe.—I am yours obediently,

H. P. MALET.

Nettlebed, Oxon, 22nd October, 1872.

THE BRITISH ASSOCIATION AT BRIGHTON.

(Continued from page 164.)

GEOGRAPHICAL DISTRIBUTION OF FORESTS IN INDIA.

A paper on this subject, read by Dr. Brandis, next occupied the attention of the section. Commencing with the observation, that the character of the forest vegetation in all countries was influenced by soil, climate, and the action of man, and that, in India, the distribution of moisture was one of the most important elements in the production of vegetation, he at once plunged into details. In the north-west corner of India there is an arid tract extending from the coast of Cutch and Sindh in the south to the Salt range in the north; and from the hills of Beluchistan in the west to the Aravalli range in the east: the rainfall being less than fifteen inches. Vegetation in this district was extremely scanty, consisting of a thin sprinkling of low thorny scrub on the hills. The work of the forester was limited to those tracts which stretch along the Indus and its principal tributaries, and which are watered by the annual overflow of the river during summer. In Sindh there were on both sides of the Indus 352,000 acres of government forest, maintained solely by the overflow of the river and by percolation. In another part of Sindh the Babool forest covered upwards of 30,000 acres, and the shade in them was so dense that very little grass and herb would grow. But when the river forsook its old bed and broke through in another direction, a part of the forest was left dry, and eventually perished. Outside this arid belt, there were two belts with a rainfall between 15 and 30 inches, which might be called the dry zones of India. The spontaneous arborescent vegetation was scanty, save in the moist lands along the great rivers, but it was better than in the arid tract. In the southern dry zone, comprising part of the Deccan, was the country of the sandal wood, a small tree which did not grow gregariously, and did not form continuous forests. Here, too, were the ancient irrigation works, tanks, and gigantic stone dams across rivers, and where water was thus supplied fields and gardens were most luxuriant. In the rest of India, outside these dry and arid belts, the annual rainfall exceeded 30 inches, save north of the first great range of the Himalaya, where the fall of rain was scanty, and consequently the country was arid and bare. With these exceptions, the rainfall of India was greater than that of Europe. Nevertheless, even in those moister parts, the conditions for forest vegetation were not everywhere as favourable in India as in Europe. Really thriving forests were only found where the fall exceeded 45 inches, and luxuriant vegetation was limited to those belts which had a much higher rainfall. There were two moist zones, where the annual rain exceeded 75 inches, the smaller one along the western coast of the peninsula, and the more extensive one on the outer Himalaya ranges, the hills of Bengal, and the coasts of Burmah. On the western coast the rainfall was moderate as far down as Surat, 47 inches, and Bombay had 72 inches; but Janna, only a few miles inland, had 102. Further down the coast the rainfall was heavier. Ruttanahem had 115, and Canara had 123 inches. Approaching the southern extremity of the peninsula, the rainfall gradually diminished to 28 inches at Cape

Comorin. In this narrow moist belt were found some of the finest forests in India. The teak forests of North Canara, protected by the difficult nature of the country, the teak and blackwood forests of Wynaad and the Anamallays, and the forests of Travancore, were reputable forests, which might stand comparison with the oak and beech forests of the Spenart, and the oak forests of Central France. The teak plantations of Nellumboor, in Malabar, which were commenced in 1844, and now covered upwards of 2,400 acres, were a splendid instance of luxuriant forest growth on a good soil, in a foreign climate, and under good management. The moist region of the Himalaya, and the eastern part of India, had a much larger extent. The Kangra valley, in the Punjab, had a rainfall of 100 inches, and from here the moist narrow belt, but widening gradually, ran in a south-westerly direction as far as Sikkim. Near Simla, the width of this belt, with a rainfall of 75 inches, was not more than 30 miles. Near Darjeeling, it extended into and comprised the whole of Assam, Eastern Bengal, as far as Dacca and British Burmah. A second belt of between 60 and 75 inches, ran outside the foot of the Himalaya, comprising the estuary of the Ganges and part of Orissa. Within these moist regions of northern and eastern India, were a great variety of good forests. Only a small portion of the deodar forests of the north-west Himalaya fell within this belt, the greater part lying inland, where the rainfall was less than 60 inches. The india-rubber forests of Assam and Cachar were within the range of the heavy rainfall, as well as the ironwood forests of Arracan and the teak forests of British Burmah. Between the dry and moist belts there lay a vast tract of country with an annual rainfall varying from 30 to 60 inches. Within the moist regions, with a rainfall exceeding 60 inches (in one place rising to 250 inches) and in Eastern India, there was a great variety of good forests. Of the deodar forests of the north-west Himalaya, a small portion only fell into this belt, the greater part lying in land where the rainfall was less than 60 inches. Between the dry and moist regions was a vast tract of country with an annual rainfall of more than 30, but less than 60 inches, comprising the greater portion of the upper Gangetic plain, the whole of Central India, and the western side of the peninsula. In this part of India the main obstacle to a luxuriant forest growth was, not so much an insufficient supply of moisture, as its unequal distribution over the seasons of the year. The jungle fires were also most fatal to forest growth in these regions of India. The protection of forests against this scourge was not an easy matter, but thanks to the energy of Colonel Pearson, fires had been excluded from several forest districts of the Central Provinces ever since 1864, and the improvement in their condition was marvellous. Up to the present time, however, many otherwise observant people in India, and even officers connected with the administration of the public forests, had been of opinion that these fires were not mischievous, and might in some cases be beneficial. The action of man upon the forests of India had until within the last few years been directed towards their deterioration and destruction. It was indeed remarkable that in a great portion of the arid and dry regions of India large extents of forest land had been preserved by the native rulers. The beginnings of forest conservancy were thus found where forests were scarce and grew under unfavourable conditions; but effectual conservancy was now only possible in those forests over which Government had complete control. The operations of forest officers in India, therefore, must be directed towards obtaining a separation of private and public rights in the forest land. These public domains, clothed with forests, which, as a rule, it would not be to the interest of the private proprietor to maintain, would not only serve to supply the future requirements of the country, but would be a source of strength, financially and politically, to the British Government in India.

TEMPERATURE CORRECTION OF THE ANEROID.

Professor Phillips read a paper on the temperature correction of the aneroid; he argued that with care in the use of the instrument, and in the application of temperature corrections, the aneroid was more reliable than Mr. Scott and some other meteorologists seemed to think, and he stated his own experience with an aneroid for which he had drawn up a table of corrections for varying temperatures,

In spite of very rough usage, the instrument continued to give very accurate results when the temperature correction was applied. He had also obtained some instruments which professed to be compensated for temperature, and had found the compensation of some of them to be nearly perfect.

Mr. Glaisher stated that from his experiments at the Observatory at Greenwich, those aneroids, which professedly were "compensated," proved, on being tested, worse than the others.

Professor Babbage said that travelling on horseback with aneroids, as he had done in Australia, tended to render their indications unreliable, because of the jolting.

A NEW HYGROMETER.

Mr. George Dines read the following paper on his new hygrometer.*

Before describing the instrument to which this paper refers, I will briefly state the circumstances which led to its production. In making some experiments upon evaporation, it was considered necessary to determine the temperature of the dew point accurately. Circumstances connected with those experiments, which need not be alluded to, made me doubt as to whether the dry and wet bulbs were sufficiently accurate for the purpose. One of Daniell's hygrometers was therefore obtained, but not being accustomed to its use, I found it extremely difficult to manage; the ether was also rather expensive. I therefore cast about for some other means of determining the dew point—the instrument here described is the result. For using this instrument, water only of a lower temperature than the dew point is required; in summer well water will generally be found sufficiently cold, but, if not, ice is recommended as the simplest means of cooling the water. In severe frost, when ice is always to be obtained, salt mixed with the ice will generally give a temperature sufficiently low for the purposes required. The water is placed in the vessel A; the tap B is opened, which allows the water from A to flow through the chamber D, and to cool the THIN black glass E with which that chamber is covered. As soon as the dew appears upon the surface of the glass, the tap B is turned off, thus preventing any further flow of the water, and the attached thermometer, the bulb of which is placed inside D, close under the surface of the glass, gives the temperature of the dew point. Before deciding upon the use of black glass as a cover to D, I had tried most of the metals. Owing to the non-conducting and other properties of glass, doubts have been expressed as to its fitness for the purpose. I have therefore made one of these hygrometers, the chamber D of which holds nearly a quart of water. This is covered partly with glass and partly with highly-polished gilt metal. That hygrometer is now upon the table, and I hope to give you the opportunity of judging for yourselves whether glass or metal is the best. After using this instrument for some time, and under different conditions, I have come to the same conclusion as the late Professor Daniell—that the metal possesses no advantage over the black glass—the colour of the glass, its highly polished surface, combined with small cost, are great recommendations when compared with the metal. The time at my disposal for work of this description is limited, but I have made many observations with the hygrometer side by side with the dry and wet bulbs. I do not wish, at present, to speak positively upon the subject, but the conclusion arrived at in my own mind is this—that, whatever tables may be used, the dry and wet bulbs can never be depended upon as giving more than an approximation to the dew point. I find also that on many days the amount of moisture in the air is very unequally distributed—that it is subject to rapid and frequent changes. I have elsewhere described it as badly mixed, and also to "masses of air, very differently charged with moisture, rolling over the surface of the earth in the same manner as the clouds above, the difference being that they are invisible."

* A notice and engraving of this hygrometer appeared in this Magazine, Vol. VI. p. 147, but several additional facts are mentioned in the present paper, and for that reason, as well as because we consider the instrument of great utility, we insert it verbatim.

OCTOBER, 1872.

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 .01 or more fell.	Max.		Min.				
				Dpth.	Date.		Deg.	Date.	Deg.	Date.	In shade	On grass.	
		inches	inches.	in.									
I.	Camden Town	5.20	+ 2.61	1.05	21	20	65.3	3	31.8	13	2	6	
II.	Maidstone (Linton Park)	4.48	+ 1.38	.52	31	22	67.0	2	30.0	12	...	...
III.	Selborne (The Wakes)	6.81	+ 2.60	1.30	24	20	63.0	2	29.0	17*	9	10	
IV.	Hitchin	3.73	+ 1.18	.48	24	24	62.0	3	31.0	5†	3	...	
V.	Banbury	3.45	+ 1.02	.48	10	21	62.0	1, 2	26.0	14	4	...	
VI.	Bury St. Edmunds (Culford)	3.12	+ .41	.56	20	23	66.0	2	29.0	13	5	9	
VII.	Bridport	6.76	+ 2.73	1.35	24	23	63.0	7	27.0	15	5	...	
VIII.	Barnstaple	7.41	+ 3.29	1.09	30	28	65.0	16	31.5	15	...	...
IX.	Bodmin	8.10	+ 2.78	1.30	30	27	60.0	6	41.0	14	0	2	
X.	Cirencester	3.65	+ .16	.60	24	17	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall)	6.07	+ 3.83	1.14	20	20	61.0	2	28.0	15	6	...	
XII.	Tenbury (Orleton)	4.52	+ 1.29	.67	20	22	63.0	2	29.0	15	7	11	
XIII.	Leicester (Wigston)	3.72	+ 1.02	.83	20	21	65.0	2	27.0	13	7	...	
XIV.	Boston	3.17	+ 1.05	.47	20	24	64.0	3	31.0	15	1	...	
XV.	Grimsby (Killingholme)	3.04	...	.37	20	20	63.5	2	31.5	15	1	...	
XVI.	Derby	4.56	+ 1.72	.99	20	21	61.0	2	30.0	13	2	...	
XVII.	Manchester	4.40	+ .59	.86	21	23	62.5	2	28.0	20	...	...
XVIII.	York	3.94	+ 1.42	.60	20	23	61.5	2	30.5	16	2	...	
XIX.	Skipton (Arncliffe)	7.28	+ .62	.82	10	23	59.0	3	26.0	14	5	...	
XX.	North Shields	5.96	+ 2.68	1.76	10	21	59.8	2	32.2	15	0	2	
XXI.	Borrowdale (Seathwaite)	19.13	+ 2.81	5.00	29	20	...	...	...	...	...	...
XXII.	Cardiff (Ely)	5.76	+ .01	.64	31	25	...	...	...	...	...	...
XXIII.	Haverfordwest	7.93	+ 2.74	1.21	16	23	61.0	2	30.0	12†	4	5	
XXIV.	Rhayader (Cefnfaes)	8.60	+ 3.00	1.30	10	18	61.0	...	26.0	...	...	...
XXV.	Llandudno	8.17	+ 4.21	1.10	21	23	60.4	1	35.1	5	...	...
XXVI.	Dumfries	4.61	...	.31	.84	10	18	60.0	2	28.0	15	5	...
XXVII.	Hawick (Silverbut Hall)	3.86	...	.87	21	20	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House)	4.07	...	.88	1.00	6	21	59.0	1, 2	24.0	5	4	7
XXIX.	Castle Toward	5.71	...	.04	1.32	1	19	...	...	...	...	...
XXX.	Leven (Nookton)	3.58	...	.17	.70	21	16	61.0	2	28.0	5§	4	16
XXXI.	Stirling (Deanston)	3.48	...	1.48	.78	29	20	58.8	2	23.0	5	5	8
XXXII.	Logierait	4.98	...	.78	24	22	...	...	...	...	...	...
XXXIII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Aberdeen	4.38	...	1.06	11	26	57.4	2	34.9	5	0	12	
XXXV.	Inverness (Culloden)	3.37	+ .71	.87	22	22	58.0	1	33.9	5	0	8	
XXXVI.	Portree	7.68	...	3.10	1.08	1	31	...	...	...	...	...
XXXVII.	Loch Broom	7.72	...	1.63	22	28	...	...	...	...	...	...
XXXVIII.	Helmsdale	5.03	...	1.10	21	28	...	...	...	...	...	...
XXXIX.	Sandwick	4.72	...	.82	21	27	57.9	2	34.7	5	0	5	
XL.	Cork	5.27	...	.80	17	17	...	...	...	...	...	...
XLI.	Waterford	3.31	...	1.09	.50	23	24	61.0	2	33.0	5	0	...
XLII.	Killaloe	5.69	+ .67	1.07	29	22	62.0	2	29.0	5, 16	2	10	
XLIII.	Portarlington	4.22	...	.91	.63	7	29	59.0	1	29.5	4	3	...
XLIV.	Monkstown	3.56	...	.36	.52	16	18	...	...	...	...	...
XLV.	Galway	6.45	...	.67	29	23	69.0	6	31.0	5	3	...	
XLVI.	Bunninadden (Doo Castle)	6.33	...	.68	9	30	...	...	...	...	...	...
XLVII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	4.51	...	.89	10	18	62.0	2	28.0	3	3	13	
XLIX.	Strabane (Leckpatrick)	5.18	...	.74	30	25	...	...	...	...	...	...

* And 23. † And 18, 16. ‡ And 22. § And 6, 15.

+ 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.

LINTON PARK.—A mild but wet month; high winds on 16th, 24th, 27th, and 30th. TS on 26th. Winds mostly S. and S.W. Bar., which was high on the 7th, became very unsteady afterwards, and fell to the lowest point, 28·83, on 25th. The latter part of the month very unfavourable for farming and other outdoor work.

SELBORNE.—The wettest month this year excepting January; hitherto a very wet year, no less than 37·17 in. having fallen at the end of October, 10 months; altogether a damp and dreary month; prevailing winds S.W. and W., and occasionally very violent; slight TS on 3rd; very high wind on 10th, with heavy R; a little H and S fell on the 11th. Thrush singing all the morning of the 27th.

BANBURY.—Bar. 28·8 at 56° on 10th at 11 p.m., and on the 24th at 52° at 5 p.m.

CULFORD.—A month of continuous rainfall, and in no instance more than two days together free from R. The weather has also been cold for the season, the mean temp. being 47°. T on 3rd; swallows last seen on the 5th or 6th; high wind (bar. 28·60) on 10th; H on 13th.

BRIDPORT.—A very wet month and low bar.; the total is the greatest amount registered (with the exception of December, 1868, when the total fall was 6·88, September, 1867, 7·39, and October, 1865=7·70) for the last 15 years; very sharp white frost on 15th; very heavy storm at 3 a.m. on the 26th; gale on 29th.

BODMIN.—Aurora at 10 p.m. on 21st.

CIRENCESTER.—The fall of rain for August 7th was 1·42, but entered at ·42, the true monthly total is 3·27.

SHIFNAL.—Another month of almost daily R till the 27th. R commenced at 3.30 p.m. on 20th, and continued till midnight on the 22nd, total fall, 1·90; wind varied from N.W. to S.W. till 16th, when it changed to N.E. and S.E. for five days, and continued to change every three or four days to the end; most farmers unable to plough for wheat even on light soil; potatoes a light crop, very small, and sadly diseased; fieldfares first seen on the 19th. The wettest October for 38 years, and perhaps more, the nearest to it that of 1843, when 5·22 in. fell; 13·14 in. now above the average for the year at this place.

ORLETON.—A very rainy month, and remarkably cold, except a few days at the beginning and again at the end. Mean temp. nearly 4½° below the average; S on the hills on the 12th; frequent frosts in the nights followed by R; rivers flooded on the 22nd; distant T on the 30th. No violent winds, but bar. generally low.

WIGSTON.—Mean temp. below the average. The continued showery weather throughout the month has interfered with agricultural operations.

BOSTON.—Total rainfall for ten months ending October 31, is 26·67 in., or 8·22 in. in excess of average of previous ten years, and 4·19 above the total due for the whole year. Temp. for month 2·2° below average previous eight years. Rain ·90 above average; prevailing wind S.W., blowing nineteen days from that quarter; bar. ·22 below average; on 21st and 22nd rain was incessant for thirty-six hours, and amounted to ·82.

GRIMSBY.—Thick fog on the Humber on the 15th; low bar.; very few fine days; the ground too wet for sowing wheat on heavy lands; last day of the month drying, with a high wind; L on 31st, and high wind on the 29th.

DERBY.—A very wet, disagreeable month. The rainfall of the 20th and 21st flooded all the low lying land about here; the fall during the month is 2 in. above the average, and the yearly mean of rainfall has already been exceeded by 7·0 in. and the average up to the end of October by 11 in.; temp. 3° below the mean.

YORK.—L at 7.30 p.m. on 31st.

ARNcliffe.—A very wet month.

N. SHIELDS.—Heavy storm on the 10th, 2·28 in. of R fell between 3 p.m. on 10th and 11 a.m. on the 11th.

W A L E S.

HAVERFORDWEST.—The month commenced stormy and wet; the only fine weather occurred from the 3rd to the 6th, when it was fine and frosty; from that time to the end it was one continued downpour, at times very stormy, especially about the 24th, when the bar. corrected for temp. stood at 28·97 at 9 p.m.; H, R, T, and L during the day and evening of the 25th; heavy floods during the last days of the month. Much corn still in the fields, necessarily much loss will be experienced, as the weather still continues hopelessly bad. General health, good.

RHAYADER.—A month of wet, ungenial weather. Temp. low; wind N.E. and S.W.

LLANDUDNO.—No swallows seen after the 2nd; S on the distant hills on the 3rd, 4th, 5th, and 6th, and from 10th to 14th; H on 9th and 11th; heavy gale on 23rd, and till 9 a.m., 24th.

S C O T L A N D.

DUMFRIES.—This month on the whole has been wet, and occasionally stormy. Temp. 1°·7 below the mean of the corresponding month of last five years; S on 16th. Harvest completed by the middle of the month, the crops less injured than expected; potatoes much diseased.

HAWICK.—The severe frost on the 3rd, 4th, and 5th completely ruined the flower garden, but with the exception of the night of the 14th, we had no other frosts during the month. There was a great deal of L, and one or two peals of T on the very stormy night of the 29th, but the month on the whole has been remarkably mild, most of the R has fallen in the night.

AUCHENDRANE.—Bright aurora on the night of the 13th; L on the night of the 24th; slight gale on 29th and 30th; L and distant T on night of 30th and morning of 31st.

CASTLE TOWARD.—Beginning of month dull and wet, the middle mild and bright, towards the end cloudy and dull; the Arran hill tops covered with S on the 4th; a severe storm of T and L, followed by high winds from the W. on the 30th and 31st. Potatoes very scarce, and turnips not half as many as last year.

NOOKTON.—Storm on 31st.

DEANSTON.—Some smart frosts in the beginning of the month, but fair and favourable for the ingathering of crops. Potatoes in most cases diseased. The last few days of the month very stormy, blowing a S.W. gale, with R, T, and much L, on the morning of the 30th and throughout the day.

ABERDEEN.—A month of average temp., but stormy and wet. Bar. and temp. below the average of 15 years; rainfall and pressure of wind above it.

PORTREE.—The month was very wet and stormy, and has failed for once of proving itself to be the Highlanders' harvest, as it is wont to be. T, L, and H showers all through the night of the 29th till 8 a.m. on 30th, and a perfect gale blew continuously from the S. and S.W. from 1 a.m. on 30th to 9 a.m. on 31st. Much of the corn is yet unsecured, and the greater part of the potato crop is still in the ground.

LOCHBROOM.—Every day but three was wet and stormy; September was bad, but October was worse, having one less fine day, and nearly an inch more R. Crops housed in a very bad state, grain and straw much damaged; potatoes not good, and only about half the quantity. A terrific TS on the night of the 31st, stopping telegraphic communication, and breaking an A B C instrument.

SANDWICK.—October is generally our wettest month, and though the R in each month since March has exceeded the mean, yet October exceeds them all, but it is only just about the mean for October. Temp. 1°·2 below the mean, and the weather unfavourable for the conclusion of harvest operations, particularly for taking up potatoes, which are but a poor crop, and much diseased. Aurora on 3rd, followed by a gale of 65 miles an hour; bright double rainbow on the 9th; a gale of 50 miles an hour, or 1107 miles, between 10 a.m. on 30th and 10 a.m. on 31st, and following aurora on 29th, and a bar marking 28·63 on 30th.

IRELAND.

MONKSTOWN.—Month very wet, but not cold, scarce any frost; T and L on 19th; swallows flying about on 27th, but none seen on 28th or since that time.

DOO CASTLE.—A continual downpour, floods immense, and land, even hilly land, completely saturated. Fuel very scarce. Potato yield but small, and much diseased.

WARINGSTOWN.—Very wet; such a continuously wet autumn is not supposed to have occurred since 1816. Some grain still in stook, and most of the potatoes still undug.

A BIRCH TREE STRUCK BY LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—I think there is an opinion amongst students of electricity that the beech, birch, and maple are very seldom struck by lightning. An instance to the contrary occurred in Cheshire, in one of the storms of August. The storm had been gathering for some time, with every appearance of heaviness; it discharged itself in one thunderclap, unattended with rain. The lightning took effect on a good sized birch tree, the trunk of which was about $2\frac{1}{2}$ ft. in diameter, standing nearly alone in a hedge, and must have struck it horizontally. The tree now has the appearance of having been cut in two by a cannon shot midway; the lower part is pretty clean cut. Part of the head lies prostrate along the hedge about due E., and is only connected with the butt by a strip of wood and bark about as thick as two fingers. It is scorched all through the branches and leaves, as is also the hedge for three or four yards on either side. The intermediate portion (about 6 or 7 ft.) is split up into many pieces, one of which is as much as I can lift, all carried in one direction (about S. by E.) to a distance of eight or ten yards into the field, the ground from the root to the bottom of the ditch is considerably disturbed as if by a slight explosion underneath. I have seen trees struck by lightning to the extent of having the bark ripped open, and a branch or so knocked off, but never saw or heard of one so utterly smashed up as this, nor so evidently by a horizontal blow. The keeper on the ground when it occurred was in the field adjoining, and saw it done.—Yours truly,

F. GARTSIDE TIPPINGE.

Sansaw, Shrewsbury, Oct. 20, 1872.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

LXXXIII.]

DECEMBER, 1872.

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NOTES ON RAINFALL IN NOVEMBER.

A glance at our usual monthly table will show that the excess which characterized October has been repeated in November, in an equal or intensified degree. The excess has on the whole been tolerably uniform, but there have been some local peculiarities in Kent, which at present we have not sufficient data to fully explain. The following are the facts, their verification and explanation must await the receipt of all the Kentish returns at the approaching close of the year.

I. A new rain gauge has, through the kind assistance of Mr. G. Anderson, recently been placed at the Gas Works, Buckland, Dover, and the amount reported for November is 10·17 in. This seemed so extremely large an amount that we at once proceeded to compare the daily entries with those published in the Daily Weather Reports, and we found the total to be 9·01, and the daily observations at the two stations to hold similar ratios. We know nothing of the position of either gauge, but can readily imagine that the contour of the country would produce a large fall in the valley at Buckland, and therefore the reports may be held as evidence of a fall of ten inches at a locality where the November average is probably not one-third of that amount.

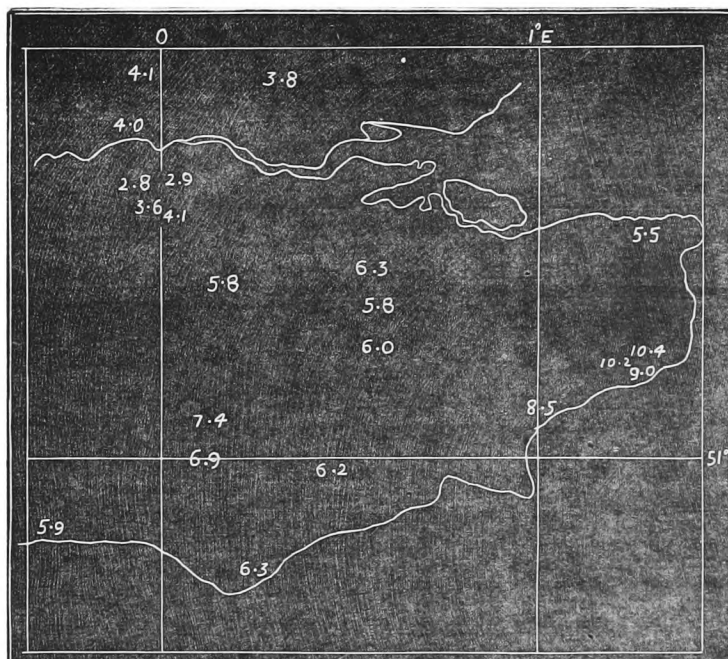
II. There are two gauges at Eltham, in West Kent, one taken daily, the other at irregular intervals; they agreed within one or two hundredths in giving only 2·90 in. as the total for November, while that at Forest Hill was still less, being only 2·79 in., which is as noticeable for its smallness and remarkable for its dissimilarity to those surrounding stations from which we have at present received returns, as are the Dover returns for excess.

These features will, however, be readily seen from the accompanying little chart, and table of supplementary returns, and we need not pursue the subject further, except to point out its dependence for proof on closely adjacent stations. With stations at the wide distances sometimes held to be sufficient, facts like these could not be detected, and if they happened to occur at one isolated station there would be no means of proving whether it was a veritable occurrence or arose from errors of observation.

Since writing the above, we have received from our observer at

Castle Street, Dover, his return for the month, which slightly exceeds even Buckland, and also the return from Hythe, which, by a diminution of about one-and-a-half inches, proves at once the accuracy of two at least of the Dover returns, and its own correctness. The figures therefore stand thus :—

Dover, Castle Street	10·44
„ Buckland	10·17
„ (Daily Weather Report)	9·01
Hythe	8·53



	in.		in.
I. Harrow	3·93	III. Berkhamstead	4·45
Winchmore Hill... ..	4·05	Great Missenden	4·48
Riverdale, Hanworth ...	2·93	Addington	3·10
Pinner Hill ..	3·82	Sandy	3·37
Muswell Hill	4·07	IV. Wix	3·79
II. Bucklands, Dover	10·17	Ipswich	4·30
Castle-street „	10·44	Diss	4·13
Hythe	8·53	Swaffham	4·81
Boxley Road, Maidstone	6·31	Hillington.....	4·32
Staplehurst Place.....	6·03	V. Tytherton	4·69
Riverhead	5·84	Bingham Melcombe.....	6·53
Acol	5·52	Blandford, Longthorns...	6·50
Bromley	4·08	Beaminster	6·73
Chislehurst	3·63	Holne... ..	13·36
Eltham	2·90	Druid.....	9·28
Worthing	5·88	Prison Reservoir	8·24
Meads, Eastbourne	6·31	„ Garden	12·38
Salehurst	6·21	Rundlestone	11·36
Uckfield	6·92	Kilworthy, Tavistock ...	8·74
Crowborough	7·39	Okehampton.....	7·53

	in.		in.
Clawton.....	6'00	XI. Heyhope	8'63
Poughill	4'89	Plas Brereton	6'32
Taunton	4'05	XII. Melrose	5'45
VI. Sansaw	3'31	XIV. Holehouse	5'75
Buglawton, Congleton...	2'98	Cessnock	4'53
VII. Mansfield	3'49	XV. Glengorm, Isle of Mull...	6'61
VIII. Macclesfield	3'93	Glen Etive, Argyllshire	12'35
Bolton	4'80	XVI. Dundee	4'79
Broughton	5'38	XVII. Nairn.....	4'24
IX. Beverley	3'93	XVIII. Tain	4'04
Buckden, Shipton	13'13	Strathconan	6'61
Middlesboro'.....	2'80	Gairloch	5'78
X. Birkside.....	16'50	Sligachan	11'50
Matterdale	10'50	Budgate, Cawdor	4'37
Gowbarrow	10'50	XX. Glenville	6'63
Grasmere	14'00	Glenbehy, Cara	9'22
Mardale.....	13'75	Lake Side „	8'22
Measandbecks	8'50	Clonmel.....	5'57
Swarthfell	8'50	XXI. Twyford	6'17
Sharrow Bay ..	7'45	XXII. Ballinasloe	5'83
XI. Llanfrechfa	9'67	XXIII. Belfast	4'88
Bridgend	12'44		

REMARKABLE FALL OF METEORS.

[The following selection of letters will serve as an indication of the principal features of the display produced by Biela's comet on Nov. 27th. Dr. Moore was kind enough to telegraph to us to look out, but alas! our view, as conjectured by Mr. Boys, was limited to the lining of M. Poey's *Pallium*—the sky in London was wholly obscured by uniform cloud.]—Ed.

To the Editor of the Meteorological Magazine.

SIR,—I send you a few notes respecting the very remarkable fall of meteors on the evening of Wednesday, November 27th. At 5.50 p.m. (Dublin time) my attention was first directed to the fact that an unusually brilliant display of falling stars was in progress, by observing three bright meteors in quick succession. They fell along diverging paths, which I was soon able to trace backwards to their union at a point nearly midway between Cassiopeia and Pleiades. In a short time it became possible to fix the radiant point with greater accuracy, for within a very few minutes so many meteors had fallen that the radii were easily traced to a focus. This I determined to be a short distance to the north-west of the star Almach, in Andromeda. My friend, Professor Robert Ball, of the Royal College of Science, ascertained by observation that the radiant point nearly coincided with the star "46 Andromedæ," although it varied slightly.

As the night was almost calm a considerable quantity of smoke gathered over the city, and dimmed the sheen of the stars from time to time; occasionally, too, detached clouds and masses of vapour fog obscured the sky in places for a short period. Notwithstanding these

drawbacks the heavens, as seen from Dublin, presented a striking and beautiful spectacle. At nine o'clock the sky was quite clear and the stars bright. As the radiant point was now near the meridian, and at a great altitude, the meteors fell in all directions, almost from the zenith, I should say at the rate of at least twenty a minute.

From this time, the number became gradually less, but two hours later the fall was still remarkable. At 10.55 p.m., a most splendid meteor shot northwards from the radiant point, and left a train of dazzling sparks in its path. Almost at the same moment, a pale star appeared far away to the N.E., and passed rapidly and with changing light athwart the sky, finally disappearing in the extreme S.W. It did not seem to belong to the great display from Andromeda, but was rather a wanderer, such as might be seen on any night in autumn.

An eye-witness of the wonderful meteor-shower of November, 1866, I had not hoped so soon to see such a display as that of Wednesday night. I calculated that in six hours at least 5,400 falling stars might have been seen from Dublin, and this number is possibly far below the true one.

In conclusion, I would ask, as no unusual display of meteors was observed—so far as I am aware—on Nov. 13 and 14, was this display the ordinary November shower delayed some 14 days beyond its ordinary period,—I am, Sir, yours very truly,

J. W. MOORE, M.D.

40 Fitzwilliam Square, West, Dublin, November 28th, 1872.

To the Editor of the Meteorological Magazine.

SIR,—It may interest some of your readers to know that on the evening of November 27th there was seen here an unusual display of "shooting stars." I am not astronomer enough to know whether the appearance of these was expected, but knowing the tendency of an English November to hide behind impenetrable cloud all such phenomena, I send you an account of what was seen in Greece. The night was a remarkably clear one, and there was of course no moon. At half-past seven in the evening I happened to look out, and my attention was caught first by one meteor, then by another, and another, until it was a sight remarkable enough to deserve mention. At half-past ten, I had occasion to go out, and noticed that the shower of meteors was as thick as before; and then observed the sky at intervals until midnight, when I determined to count them for a while. Standing on my balcony, which looks N.W., and commands a view of one half the sky, I began to count, and in $7\frac{1}{2}$ minutes had counted one hundred. I then moved to my terrace, which looks S. and commands at most a quarter of the sky, and here I counted fifty in $4\frac{1}{2}$ minutes. I neither saw nor heard of any of remarkable size or brilliancy, but I noticed them to be distributed very evenly over the sky, and all to diverge from a point about 5 degrees W.N.W. of the zenith at midnight, (Patras is situated on latitude $38^{\circ} 17'$ and on longitude

21° 46') and as my eye could not possibly take in all that appeared, some of them very small ones, it is perhaps probable that they appeared at the rate of 50 a minute for some hours.

Since the inundations in Italy this autumn have been so destructive and so well known, it may perhaps be interesting to you to hear that on the western side of Greece there has been an unusual deficiency of rain, the rainfall of Patras for the months of September, October, and November being less than a quarter of that of the corresponding months last year. Still more curiously, at Athens, on the E. side of Greece, only 100 miles from Patras, the autumn has been an excessively wet one during its late half.—Yours sincerely,

H. A. BOYS.

Patras, Greece, Nov. 30, 1872.

To the Editor of the Meteorological Magazine.

SIR,—I inform you with pleasure that we had a shower of falling stars last evening, (November 27th), commencing about 6 p.m., and continuing until about 9 p.m. They appeared in every part of the heavens, and some were of great brilliancy. The barometer was rising, and to day it is very bright and fine, after a long period of wind and rain,—I remain, Sir, yours truly,

T. DODGSON.

Thorpe Grange, Greta Bridge, Barnard Castle, Nov. 28, 1872.

To the Editor of the Meteorological Magazine.

SIR,—Last night we had here a fine display of Meteors. The “shower” began at 6h. (Greenwich time) and continued without intermission till 10.20., when the sky became partially clouded and continued so till after 11h., when it again partly cleared and meteors at short intervals were observed still to fall, and up to 3 o'clock this morning they had not entirely ceased; by 5, however, none were visible.

This “shower” was more copious than any witnessed since the night of the 13th of this month in 1866. The focus from which the meteors emanated is between Perseus and Cassiopeia, and only 2° or 3° to the N. of the star Almach in Andromeda. They shot forth in all directions, and often from 2 to 4 together, and so fast as to number from 15 to 30 a minute—so that in 4 hours it is computed that upwards of 3,000 must have fallen. Most of them were of a whitish colour, but some of a red and yellow hue. These were larger than the rest, and equal to stars of the 1st magnitude—leaving trains of 2° and 3° which, after the bursting of the nucleus, remained visible for 5 and 10 seconds. The most remarkable meteors of this colour were observed at the following times, 7h. 20m., 7h. 24m., 7h. 42m., 7h. 58m., and 8h. 3m. Three of them shot towards Ursa Major and the other two passed to the right of the Pleiades. The greater number of the light coloured meteors varied in size between stars of the 2nd and 4th magnitude, but some were so small as to be scarcely visible.

An arch of Aurora spanned the sky between N. E. and W.N.W. at

about 20° above the horizon, shooting up occasionally in "streamers" towards the zenith, greatly adding to the effect produced by the meteors. The night was frosty and nearly calm and clear, enabling this remarkable "shower" to be seen to the greatest advantage. If it be connected with the periodical one of the night of the 13th, the constellation from which the meteors emanated is very different. The 28th of November is one of the dates given in the instructions of the British Association for being on the "look-out" for meteors, but such a "shower" as occurred on the night of the 27th is surely scarcely to be expected.—I am, Sir, yours truly,

ARTHUR FORBES.

Culloden, near Inverness, N.B., Nov. 28, 1872.

THE GALE OF DECEMBER 8TH.

ALTHOUGH we have somewhat increased the size of the present number, we have not space for one quarter of the notes with which we have been favoured respecting the recent gale. We insert, however, those for which we have room, and prefix a comparative table of the pressures recorded by several of the anemometers in various parts of the country; arranging them in the order of their amount we have:—

Guernsey	53 lbs.
Beckenham	$31\frac{1}{2}$ „
Wisbeach	23 „
Holborn	$18\frac{1}{2}$ „
Sidmouth.....	10 „

If each of our readers who possesses an anemometer will favour us with the total horizontal motion of the air between 8 or 9 a.m. on the 8th and the same hour on the 9th, we will throw the information into a tabular form, and think it would prove generally interesting.

To the Editor of the Meteorological Magazine.

SIR,—The following particulars of the gale of Sunday, Dec. 8th, may be of service in tracing its history. It was, undoubtedly, the heaviest gale that has been experienced in this neighbourhood for many years. This is proved by the damage done. In all directions large trees (leafless, be it remembered,) have been torn up by the roots or snapped off in the middle of the trunk, while the injuries to houses and public buildings have been beyond anything that most people can remember.

The gale began about 3 p.m., on Sunday, and continued until about 6 a.m., on Monday. Its greatest violence was from 8 p.m. to 3 a.m.

The direction of the wind was at first S. and S.S.E., veering about 5 p.m. to S.W., about 8 p.m. to W.S.W., and between 9 and 10 p.m. to W., near which point it remained during the night, possibly reaching W.N.W. for a time.

The maximum force was estimated at 5, on the scale of 0—6.

The barometer fell with great rapidity during the first part of the gale, reaching its minimum at 8 p.m. The following are the hourly readings for four hours on either side of the minimum. They are corrected for index error, and capillarity, and reduced to a temperature of 32°. The height above the sea is 228 ft. The times are local.

4 p.m.	...	...	...	...	28·765 inches.
5 p.m.	...	...	...	...	28·687 „
6 p.m.	...	...	...	...	28·596 „
7 p.m.	...	...	...	...	28·534 „
8 p.m.	...	...	...	...	28·496 „
9 p.m.	...	...	...	...	28·517 „
10 p.m.	...	...	...	...	28·557 „
11 p.m.	...	...	...	...	28·594 „
12 p.m.	...	...	...	...	28·626 „

GEORGE F. BURDER, M.D.

Clifton, 10th Dec. 1872.

To the Editor of the Meteorological Magazine.

SIR,—There was a heavy gale last night and this morning. The barometer had been low and fluctuating so long that I had no suspicion of a gale. Two or three days had been fair, and Sunday was fine and sunny, but the barometer fell rapidly in p.m.

		Barometer reduced to Sea level.	Temp. of Air.		Wind.
8th Dec.	9 a.m.	29·461 in.	...	37·5	S.W.
„	3 p.m.	29·326 „	...	43·0	S.E.
„	10 p.m.	28·683 „	...	45·0	S.S.W.
9th Dec.	8 a.m.	28·761 „	...	38·0	S.W.
„	9 a.m.	28·815 „	...	37·0	W.S.W.

Pressure on square foot—8th at 5.40 p.m. 4lbs. ; at 10 p.m. 15lbs. 9th at 3 a.m. 23lbs. (the highest recorded here for 12 years) ; at 6.35 a.m. 18lbs. ; at 9 a.m. 10lbs. Rain and hail, moderate at noon ; fair, p.m.

I am, Sir, yours, &c.

SAML. H. MILLER.

Wisbech, 9th Dec. 1872.

RECORD OF OSLER'S ANEMOMETER.

Sunday, Dec. 8th, 9 a.m.—Sunshine, fresh breeze, S.S.W., backing. Barometer corrected and reduced to 32° Fah., at sea level, 29·670, 2 to 4 p.m., S.S.E., strong breeze, with heavy squalls of wind and rain ; pressure 7lbs. to 8lbs. per square foot, 30 to 40 miles an hour. Between 4 and 5, during a violent squall, the wind flew to S.W., the pressure suddenly rising to 20lbs., 63 miles. 6 p.m., barometer fallen 5-tenths, 29·142. Wind, S.W., raging with the force of a hurricane, recording for three hours, 22lbs., 66 miles, with terrific squalls of 53lbs., 104 miles an hour. 9 p.m., W.S.W., force to midnight, 20lbs., 63 miles.

Monday, 9th.—The storm continued until 6 a.m., pressure 12lbs. to 20lbs., 48 to 64 miles. 9 a.m., barometer risen 1½-tenth 29·287. Gale moderated during the day to a strong breeze from W.

The total horizontal movement of the air during 24 hours, ending at 9 a.m., on Monday, deduced from the pressures recorded by Osler's Anemometer was 1280 miles; during the same period Dr. Hoskins' Robinson's Cup Anemometer registered 1272 miles. This close agreement of the two instruments confirms their accuracy.

Tuesday, 10th, 1 p.m.—Wind backed to N.E., barometer fallen since 3 a.m., 5 tenths, to 28.770. Temperature diminished 4 degrees since 9 a.m.—reads 39 degrees. Dense canopy of leaden cloud with steady rainfall.

Let us hope that the year 1872, may long continue the "annus mirabilis" in the records of Guernsey rainfall, upwards of 52 inches having already been registered. T. L. MANSELL, A.B., M.D.

Guernsey, Dec. 10, 1872.

HEAT AS MEASURED BY NATURAL *v.* ARTIFICIAL MEANS.

To the Editor of the Meteorological Magazine.

SIR,—I would have been more glad if my article in your number for October had been replied to by writers from the country, rather than from London, as my inquiry was more especially made to those who had the opportunity of reporting both on the harvest and on the thermometer, which neither of them seem to have; and as the weather is of much greater importance to the farmer than to the townsman, I should have rather had a reply from the one most interested; however as that has not been the case, I will endeavour to answer the objections to my letter put by your not-far distant correspondents; and, in the first place, I may say that although I classed May with the summer months, I do not necessarily regard it as one, but in speaking of the wheat crop it was included as having an important bearing on that crop, and its lateness in ripening I partly attributed to the coldness of May. Further on, Mr. Brumham, whose observations I reply to, tells us when summer did begin, and I certainly commend him for waiting until it was over in doing so—a plan highly advisable for all weather and other prophets to adopt—but even in this he is not so definite as I should wish. In years gone by, old Moore used to tell us the precise day, hour, and minute when each season commenced, but Mr. Brumham is less precise, and says the past summer did not commence until a few days past the 7th of June, and lasted ninety-seven days, and in a former number of the *Meteorological Magazine* he tells us it has been a hot summer and a wet one, by which I comprehend he means a greater amount of solar heat and greater rainfall in those ninety-seven days than is usually the case, but somehow there is no rule without exception, and I take one for Linton, for allowing the few days he says it was after the 7th of June ere summer commenced, to be six (I dare say any other small number would be much the same), and say that summer commenced on 13th June and continued till 18th September, making the ninety-seven days he speaks of, I find our rainfall during that time to be 6.34 in.; and I also find that the average

of the preceding sixteen years, 1856 to 1871, both inclusive, gave a rainfall of 6.66 in. for the same 97 days, therefore the season of 1872, in accordance with Mr. Brumham's law of making it, has been a dry rather than a wet one, for I may observe that more than a fourth of the 6.34 in. stated above fell in one thunder shower on 24th and 25th June. Now, in the matter of heat, I confess my belief in the value of thermometers has been much shaken of late, more especially since the records made at Chiswick for upwards of forty years have been pronounced erroneous by some great authority, and who can say but the same verdict may be passed on those now taken at Greenwich by some after tribunal? I admit having looked on those taken at Chiswick with great respect some thirty years ago, and soon after that time commenced to take such notes myself, but of late have felt the natural test of a season's heat, or otherwise, ought to have a proper place in describing it, as well as the artificial one, and when the two don't coincide I would let the natural one have it. To make my meaning more clear; I would call every morning a frosty one in which leaves, damp cloths, and such like, "stiffen," regardless of what the thermometer readings were. But Mr. Aldridge is wrong when he says I only call in the aid of the thermometer to confirm my own views and reject them when otherwise, for the fact of the harvest being a late one not being disputed, so far as I have any knowledge, by any one (Mr. Brumham himself acknowledges it to be so), I asked if the readings of the thermometer indicated a lack of heat during the period the wheat was growing and ripening, and if these readings did give a deficiency of heat, the cause of the lateness was easily accounted for; if, on the other hand, the instruments gave a greater heat than the average, then some further inquiry ought to be instituted; the matter of the harvest being a late one being an absolute fact, not subject to any opinion or any error, whereas the thermometer (as every one knows) is liable to such mishaps,—and with the example of the Chiswick observations before us, who can say that any artificial system is right? whereas we all know there have been late and early harvests through all time, and likely ever will be, and the records of such go much further back than the hundred years Mr. Brumham takes so much pains to repeat. Moreover, late and early harvests are recorded in districts where thermometers are unknown or uncared-for, and if the information those instruments impart could be transferred to some object not subject to the derangements they are, which had also the power of denoting the temperature of every minute of every twenty-four hours constituting the day, we should then only have an imitation of the living plant, which is influenced accordingly; but as such is not likely to be the case, character of the season must be taken as conjointly between such natural and artificial means as we have within our reach; and if I have expressed a leaning to the former of these tests, I can appeal to the laws which govern other sciences for having done so.

Mr. Brumham finds much fault with me for not reporting June and

July hotter months than I did ; to this I can only say I could only report them as they were—the first a cold and the latter a medium month ; and I may add, I am not much given to guessing, neither of the past nor the future, and all my remarks on the weather (when not otherwise stated) refer to notes I have taken myself at Linton, and if these notes do not agree with what he *guesses*, they ought to be, I must leave to a discerning public to discriminate between my observations as made and recorded on the spot and his guessing of what it was to be, as insisted on by him some months ago. I have a strong impression that most people connected with rural affairs in the north and west of England will hereafter look back on the summer of 1872 as a dull, cold, and wet one, instead of the hot one promised ; at the same time do not let it be understood that I pronounce that verdict on it here ; on the contrary, the ninety-seven days which Mr. Brumham has somewhat adroitly selected for his summer (after they were passed) represented a goodly number of fine warm days, which if they had been preceded by corresponding fine weather in May and June, might have entitled the season to be called a fine warm one ; but that not being the case, I can only pronounce it, as a whole, a medium one, with harvest not more than four or five days later than usual, but at other places in the west and north it has been more backward, and the farming papers gave pitiful reports of the corn that was still out all through October, and one of your monthly correspondents I see mentions, some out at the end of that month. Surely a season that presents such a state of things will not be spoken of hereafter as “a hot one ;” that it has been a wet one I believe few will deny ; at least here taken in its entirety it has been so, although the ninety-seven days which Mr. Brumham takes for his summer were drier than the same period last year, and of the fifteen years before that—so much for prophecies !

As I hope I have sufficiently explained my reasons for dissenting from the readings of the thermometers only being taken as a proof of the temperature of a season, I need not repeat it here ; and I can only promise hereafter to reply to such correspondents as furnish meteorological observations taken by themselves. I do not mention this in any angry tone, but my former letter being more especially addressed to those versed in agricultural matters, would seem to have more weight from them than if from less experienced writers ; differing from me in the views taken I would be the last to find fault with. More I need not say.—Yours, &c.

JOHN ROBSON.

Linton.

To the Editor of the Meteorological Magazine.

SIR,—In this district we are decidedly at issue with your correspondent, Mr. Brumham, who appears to be quite satisfied with the fulfilment of his prediction of a fine and warm summer,—our share of which has been certainly *nil*, as the subjoined facts will show. Indeed the past season has been the wettest and least genial we have

had for many years ; the land has been in a constantly saturated state, and our much-enduring farmers would be vastly amazed to hear that any one considered the summer to have been a favourable one. The total rainfall of the ten months to the end of October, was 39·93 in., the wettest months being June, 6·22 in., July, 5·60 in., Sept. 4·26 in., and October 6·66 in., while only in one month, viz., May, was the fall below 2 in. Last year (1871), which was by no means very dry, the total fall in the same period was 24·54 in., while in 1870 it was only 17·20 in., and in 1869, 21·99 in. Rain has fallen on 205 days in the ten months ; the corresponding number of days in 1871 was 159 ; in 1870, 123 ; and in 1869, 146. Thunder was heard or lightning seen on 21 days, between June 1st and September 30th ; and on 14 days storms of considerable violence occurred.

Next as to temperature : since the early spring we have had very little really warm weather. The mean temperature was below the average in May by 3°·6, in June by 2°·3, in August by 1°·9, in September by 0°·6, and in October by 3°·6. July was the only month since April in which the temperature exceeded the average (when the excess was only 0°·3), while the months of May, June, and October were unusually cold. We hope that when next Mr. Brumham predicts a warm summer we may get a larger modicum of it than we have had in 1872.—Yours faithfully,

BOSCAWEN T. GRIFFITH,

Trevalyn Hall, near Wrexham, Denbighshire, Nov. 13th.

N.B.—Height of top of rain gauge above sea level, 58 ft. ; thermometers, on Glaisher stand, 4 ft. above soil ; rain gauge and thermometers by Casella.

To the Editor of the Meteorological Magazine.

SIR,—I am glad Mr. Robson has raised the question of “Heat indicated by crops *v.* thermometer.” I hope that in doing so he has opened the discussion of more than he thought for.

I cannot say that I know the special object originally proposed to themselves by those who initiated our system of thermometrical observations, because you have not yet published “Heat, when, where, and why it is observed,” but it occurs to me that at the present time one of the most practical uses to be made of such observations is the comparison of the climates of different countries and localities to determine their suitabilities for the cultivation of various crops, and for the residence of persons of delicate health.

For this purpose I am sure we ought to reject at once all thermometer stands as at present constructed, all thermometers protected from radiation or enclosed in vacuum jackets, and all mean temperatures. I am afraid I shall take away your breath with this assertion, but read on.

As regards vegetation it is exposed to rain, wind, evaporation, and all the extremes of solar and terrestrial radiation. What guide then can any observations, especially of mean temperature, obtained from

thermometers protected from all these things on a stand 4ft above the ground, or, if on the ground, enclosed in a vacuum jacket, afford as to the meteorological circumstances to which crops on the open surface in the immediate neighbourhood are exposed, or as to the consequent effects on their growth or ripening?

In the same way of invalids. I know well that there are often days in this part of England when my thermometer on the stand tells me it is considerably warmer than on the previous day, a south wind is blowing, the sky is bright, and the barometer rising, but my skin tells me it is a whole great coat colder than the day before; I would not turn a dog out of doors, much less let an invalid go out, and I know by experience that "the wind is blowing through water," and that there will infallibly be a southerly gale before night fall. In this case my hygrometer would give me warning, as the humidity would have increased.

I should then like to ask this question. What is the supposed use of observations made with thermometers 4ft above the ground on stands and protected from radiation, or in jackets on the ground, and of the mean temperature thus obtained, all being as it seems to me artificially removed as far as possible from the climatic conditions of the surrounding locality? I remember a gentleman, who thought of trying to introduce vine culture into this part of England, making enquiries of me as to temperature, and remarking that, in consequence of the points I have mentioned he could get no information which would be any guide to him as to the suitability of the climate for his purpose. I saw at once that what he wanted to know was the extremes of cold and heat and the amount of humidity to which his vines would be exposed during the various seasons, and as he did not propose to grow them on Glaisher stands or in vacuum jackets I could not help him. If I could have given him even the mean cold of the nights, another mean heat of the days, and the mean nightly and daily humidity for each month in the year taken from exposed thermometers and hygrometers on or very near the ground, it would have been of some value.

You know I am the avowed enemy of all means and averages, as tending to obscure all natural differences. One might as well dress all men in garments cut to a mean measure, and then wonder that they did not all look equally well.—I am, Sir, yours truly,

THOMAS E. CRALLAN.

Hayward's Heath, Dec. 3rd, 1872.

To the Editor of the Meteorological Magazine.

SIR,—I waited to see if anyone would point out what appears to me to be a remarkable omission in Mr. Robson's calculations. When we speak of the temperature of a season as high, we mean that the thermometer *in the shade* gave a high average. But one does not need to be very learned in agricultural matters to be aware that farmers do not grow their corn in the shade; and I believe that I am right in

supposing that the sun has something to do with ripening the crops. In a wet season like the past, there is less sunshine than in a dry season like 1864, and therefore the crops may well be later, even if the temperature of the air has been higher, without taking into consideration the effect of moisture at all.—I am, Sir, yours truly,

FENWICK W. STOW.

Harpenden, Nov. 25th.

CORRECTIONS FOR DAILY RANGE.

To the Editor of the Meteorological Magazine.

SIR,—With reference to the use of the Greenwich tables for deducing the mean temperature from observations at any hour, will you permit me to state my own experience in the matter? When I lived on the Yorkshire coast, I found them quite inapplicable, owing to the influence of sea breezes. In fine weather the temperature rises faster in the early morning than at inland stations, owing to the comparative absence of mist &c., and attains its maximum between 11 a.m. and noon. The wind then veers, and about 1 p.m. the sea breeze begins to blow from the E. or E. S. E., lowering the temperature many degrees, and greatly increasing the humidity. On this account the temperature at 3 p.m. averages only about 1° warmer than at 9 a.m., whereas with the same range of temperature it should be according to the tables 5° or 6° warmer. This throws the whole distribution of diurnal range into confusion, and as for the wet bulb, its monthly mean as deduced by the Tables from the 3 p.m. observations sometimes came out higher than that of the dry bulb.

Any one can see from the Quarterly Reports of the Meteorological Committee the impossibility of deducing the temperature curve at one observatory from that of another.

Still, for south-eastern and midland stations, and in a less degree for all inland stations, I believe that the tables have their use. It is worthy of remark that with the following ranges for the different months, 10, 11, 12, 16, 18, 20, 20, 18, 16, 14, 12, 10, the corrections for the mean of two daily observations at 9 a.m. and 9 p.m. are only +0.8, +1.0, +0.8, +0.4, +0.2, -0.4, 0.0, +0.4, +0.7, +0.8, +0.9, +0.8. Would it not be better to deduce the mean temperature from the mean of two such observations and the mean of the daily maxima and minima, all uncorrected by any arbitrary figures? The corrections for the mean of the maxima and minima are not required, I believe, if a louver board screen is used,—I am, Sir, yours truly,

FENWICK W. STOW.

Harpenden, Nov. 25th.

To the Editor of the Meteorological Magazine.

SIR,—I am glad to find the Rev. Wm. Eyre is opening up the subject of the correction of temperatures for diurnal range according to the formulæ, which however suitable they may be to Greenwich and the observations taken there, are I am confident unsuitable corrections to be applied to other places, and to my mind vitiate the observations to which they are applied, I have been for some months past com-

paring the results of observations corrected by Glaisher's Tables and those I return to the Scottish Meteorological Society uncorrected, and believe the latter to give a more correct account of our local temperature.

In a pamphlet I published on the climate of Sidmouth in 1867, I ventured on the following possibly heretical statement:—"The correction (if any be needed) for each place should depend on the results of a long series of observations taken in that place, and taken in connection with the extreme range of temperature. Such correction not having been made for Sidmouth, the results both with and without corrections have been given." Trusting the subject will be ventilated in your columns.—I am, &c.,

J. INGLEBY MACKENZIE, M.B., Cantab, F.M.S., &c.

Belgrave, Sidmouth.

DAILY VARIATIONS IN THE PREVALENCE OF RAIN DURING NOVEMBER, 1872.

The month of November has been marked by excessive rainfall over the British Islands. It commenced with a depression, advancing rapidly on the western coast, its southerly winds bringing rain to all parts of our islands on the 1st and 2nd. The 3rd was finer, but night brought a fresh disturbance to us, which, travelling north-north-eastwards along our western shores and extending laterally over the whole kingdom, renewed the downpour. Scarcely had it passed, before a new centre of circulation showed itself in the more north-westerly parts of the country. Its path lay, however, considerably to the northwards of us, and its motion being more easterly, the winds which accompanied it were westerly, and the rain, though rather general, was less heavy in most places. The 7th and 8th were much finer, but on the latter day a local depression passed up the Channel, bringing rain to our southern stations. An entire change then commenced. During the next two days, barometrical pressure increased at the northern stations, while it gave way in the south of France; northerly and north-westerly winds set in, and temperature fell; but the northerly current was not unmingled with other winds. Several very slight depressions appeared, in addition to a larger disturbance which formed over Holland, and thunderstorms, or squalls of hail with lightning, occurred in many places, while rain fell generally. This larger depression seems to have travelled southwards during the next few days, extending itself laterally over France as it did so. Showers of snow and hail fell at our north and north-eastern stations, heavy rain in many parts of France, and thunder occurred at Biarritz and Scilly on both the 11th and 12th—the barometer rising generally in a small degree on the 12th. On the 13th, a more decided recovery of pressure in the south of France was accompanied by the appearance of a depression in Holland; this, travelling westwards over France, made the rain, with snow and hail, general at our northern, eastern, and central stations, while the 14th involved France in the general

downfall—our western counties alone escaping. Another depression followed, just showing itself over Holland at 8 a.m., 15th, whence it travelled westwards for the Straits of Dover. The snow felt of late on the northern and eastern coasts gave place to heavy rain, which extended to all but the south-west of our islands, and continued, more or less, through the greater part of the 16th, when the depression began to fill up. A return to the general atmospheric conditions which prevailed prior to the 8th ensued; and, until the close of the month, a constant series of depressions passed northwards or north-eastwards over our western stations, bringing with their southerly and south-westerly winds the usual heavy rains, which are felt most in the western portions of the kingdom. In a few cases, the interval which elapsed between their advent was sufficient to allow of a clearance in the weather for several hours—at least at such stations as are situated in the more south-eastern counties; but often *borasque* followed *borasque* in such rapid succession that the sky no sooner became clear than cirrus and cirro-stratus rapidly overspread the sky, and the backing of the wind brought about a return of rain to all parts of the country.

Thus it will be seen that not only were our western and north-western coasts visited by *large* quantities of precipitation during the prevailing southerly winds of the early and latter parts of the month, but the south-eastern, eastern, and northern coasts (which had participated in those disturbances) came in for a considerable share of that which accompanied the depressions of the 13th—15th, in addition to what fell during the minor disturbances of the 11th and 12th. F.G.

CHEMICAL HYGROMETER.

To the Editor of the Meteorological Magazine.

SIR,—I do not think the Chemical Hygrometer described in your October number can be regarded as an acquisition to the stock of instruments now at the command of the meteorologist. It is an apparatus of great use in the chemical laboratory in the analysis of gases, and with care can no doubt be made to give excellent results exhibiting the amount of aqueous vapour in a given sample of air, but at any time the operation of determining the weight of water in a cubic foot of air, which is the desideratum of the meteorological observer, by this method is attended with no little difficulty, and requires considerable patience and also manipulative skill.

In the first place the proper filling of the tubes with calcium chloride, or sulphuric acid soaked pumice stone, is not an operation which can be performed hastily, then the weighing of the filled tubes in a chemical balance, the careful making of air-tight connections between them and the aspirator; the numerous precautions to be observed in passing the air through them—the dismounting and second weighing, the various calculations rendered necessary for obtaining the true volume of air, all tend to make the observation of humidity a laborious operation.

After all it would only give a mean value for the time during which

the large quantity of air necessary for a correct determination was being drawn through the apparatus, and at the conclusion of the experiment it is questionable whether the result would possess an accuracy equal to that generally attained by the comparison between the temperatures of the dry and wet bulb thermometers.

Although the instrument is not serviceable for observational purposes, yet I have no doubt but that it would be worth while for some one having sufficient leisure at command to make a series of comparisons between the hygrometric quality of the air given with this apparatus and that obtained with Mason's hygrometer, in order that the validity of Apjohn's formula might be tested under all conditions; this may have been already done, but I do not remember having met with any account of such an investigation.

I believe the absorption of water by sulphuric acid will eventually be made use of in meteorological enquiry, but I look rather to an instrument taking the form of Mr. Wildman Whitehouse's ingenious apparatus than to those now before us.

With regard to the second part of W. H. H. C's communication describing Leslie's experiment, I think he must have made a mis-statement, for I never before heard of mercury being frozen by its own evaporation *in vacuo* over sulphuric acid; the conversion of water into ice by this method is a well known experiment, but I do not see how it would succeed in the case of mercury, there being no tendency on the part of sulphuric acid to combine eagerly with mercury, as it does with water.

G. M. WHIPPLE.

PERIODICITY OF PREVALENCE OF POTATOE DISEASE?

To the Editor of the Meteorological Magazine.

SIR,—May I call your attention to the following facts in connection with the potatoe crop? The maximum disease occurred in 1846, just twenty-six years ago. This year has again shown a maximum, the interval halved gives 1859, which is known in this part of the country for the maximum growth of fine large and sound tubers, giving in some cases, one hundred and sixty sacks to the acre. This apparently shows a regularity of interval which it would be interesting to compare with meteorological results.—I am, Sir, yours, &c.

W. HATFIELD.

Stoke, Slough, Bucks.

[Is not the above statement fatal to the suggested explanation of the disease as connected with the frequency of thunderstorms? We know that thunderstorms have been more frequent than usual in 1872, and that the same was the case in 1859, and it is our impression that they were also in excess in 1846. If so, we have three years noticeable for more than an average frequency of thunderstorms, and our correspondent assigns to two of them a maximum prevalence of disease, and to one a minimum.—Ed.]

NOVEMBER, 1872.

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.	
		inches	inches.	in.										
I.	Camden Town	3.98	+ 1.57	.65	30	21	61.2	5	31.7	18	2	5		
II.	Maidstone (Linton Park).....	5.81	+ 2.62	.54	13	23	60.0	1	30.0	18	4	...		
III.	Selborne (The Wakes).....	5.78	+ 2.24	.74	22	23	57.0	5, 6	31.0	11*	6	11		
IV.	Hitchen	3.43	+ 1.29	.38	30	24	58.0	5, 6	30.0	17	6	...		
V.	Banbury	4.87	+ 2.67	.69	26	24	59.3	6	30.0	13	6	...		
VI.	Bury St. Edmunds (Culford).....	4.01	+ 1.62	.58	10	21	62.0	5	31.0	16	6	10		
VII.	Bridport	5.76	+ 2.60	.88	21	22	60.0	5	26.0	17	3	...		
VIII.	Barnstaple	6.27	+ 2.13	.65	30	25	60.0	7	33.0	17	0	...		
IX.	Bodmin	7.90	+ 2.92	1.24	22	26	58.0	3	32.0	15	1	4		
X.	Cirencester	4.82	+ 2.03	.77	26	21	...	...	...	...	...	...
XI.	Shiffnal (Houghton Hall)	3.21	+ 1.64	.46	15	24	58.0	6	29.0	26	6	...		
XII.	Tenbury (Orleton)	4.42	+ 1.95	.65	25	25	62.8	5	27.3	18	3	15		
XIII.	Leicester (Wigston).....	3.58	+ 1.42	.63	22	21	60.0	5, 6	31.0	17	1	...		
XIV.	Boston	2.94	+ .80	.42	15	21	61.0	5	30.0	19	1	...		
XV.	Grimsby (Killingholme)	4.11	...	.90	15	22	60.5	6	30.0	19	1	...		
XVI.	Derby	2.36	+ .73	.32	4	24	61.0	6	30.0	19	1	...		
XVII.	Manchester	3.77	+ 1.01	.97	26	22	60.2	6	31.0	19	2	16		
XVIII.	York	4.30	+ 2.32	.66	15	23	61.0	7	26.5	17	5	...		
XIX.	Skipton (Arncliffe)	10.21	+ 3.76	.87	25	27	56.0	6	24.0	18	11	...		
XX.	North Shields	4.11	+ 1.41	1.00	15	23	67.0	6	32.0	19	1	2		
XXI.	Borrowdale (Seathwaite).....	18.64	+ 1.97	3.40	5	19	...	...	...	...	...	...
XXII.	Cardiff (Ely)	5.13	+ .89	.80	25	20	...	...	...	...	...	...
XXIII.	Haverfordwest	8.71	+ 3.04	1.15	23	23	57.0	5	31.0	16†	3	4		
XXIV.	Rhayader (Cefnfaes).....	10.48	+ 5.90	3.10	23	23	57.0	...	20.0	...	...	...
XXV.	Llandudno	5.22	+ 2.06	.78	16	23	64.0	6	33.0	18	0	...		
XXVI.	Dumfries	3.92	+ .70	.46	25	20	58.0	5, 6	28.5	19	7	14		
XXVII.	Hawick (Silverbut Hall).....	4.92	...	.95	15	25	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	5.27	+ 1.20	1.02	4	19	58.0	5, 6	24.0	19	12	21		
XXIX.	Castle Toward	8.39	+ 3.75	1.95	5	17	...	...	...	...	...	...
XXX.	Leven (Nookton)	4.44	+ 1.40	.70	16	20	61.0	6	29.0	4	7	24		
XXXI.	Stirling (Deanston)	7.70	+ 4.19	1.38	4	22	60.3	6	26.9	28	11	19		
XXXII.	Logierait	5.80	...	.85	23	19	...	...	...	...	...	...
XXXIII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Aberdeen	7.18	...	1.52	1	25	60.8	6	29.7	29	3	17		
XXXV.	Inverness (Culloden)	4.34	+ 1.75	.62	27	18	56.8	6	30.8	28	2	20		
XXXVI.	Portree	9.36	+ 1.12	1.77	6	24	...	...	...	...	...	...
XXXVII.	Loch Broom	6.67	...	1.24	6	21	...	...	...	...	...	...
XXXVIII.	Helmsdale	6.45	...	.95	6	23	...	...	...	...	...	...
XXXIX.	Sandwick	5.02	+ 1.02	.69	9	27	54.4	6	31.6	28	3	15		
XL.	Cork	6.27	...	1.03	22	16	...	...	...	...	...	...
XLI.	Waterford	6.24	+ 2.29	.89	21	25	59.0	6	30.0	14	3	...		
XLII.	Killaloe	5.51	+ .62	.65	1	23	65.0	3	27.0	13	5	17		
XLIII.	Portarlington	3.39	+ .53	.52	22	27	62.5	6	28.0	12	7	...		
XLIV.	Monkstown	4.31	+ 1.42	1.04	22	22	...	...	...	...	...	...
XLV.	Galway	5.77	...	.79	22	24	63.0	6	27.0	14	6	...		
XLVI.	Bunninadden (Doo Castle) ...	5.82	...	1.00	1	21	...	...	...	...	...	...
XLVII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	4.22	...	.59	30	19	66.0	6	23.0	12	9	18		
XLIX.	Strabane (Leckpatrick) .....	...	...	...	...	...	...	...	...	...	...	...

* And 13, 14.

† And 18.

+ 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.

LINTON PARK.—A wet month, with very little frost, and scarce any fog. Winds mostly from S., S.W. and W., and often very high, especially after 14th. Atmosphere generally mild, so that geraniums and such plants out of doors are yet quite fresh. T and L on morning of 24th and 26th. Bar. generally low after the 9th; the rain maintaining a continuous flood rather than a high one at any particular time, but altogether a miserable month.

SELBORNE.—An extremely wet month, the state of the ground preventing farming operations; much wheat sowing must be postponed to the spring. No less than 12·69 in. of R in the last two months falling on 43 days in that time; tempestuous wind on evening of 1st, and the 23rd, and high wind all day on 25th. L on 14th and 22nd; TS at night on 25th and morning of 26th, and at 1 p.m. on 30th; prevailing wind S. and S.W. to the 9th; N. and N.E. to the 16th, the rest of the month S.W.

HITCHEN.—Only thirteen days without rain in October and November; S on the 11th and 13th; heavy thunder-shower on 30th.

BANBURY.—High wind on 1st, 21st, to 26th. Floods on 20th. S on 10th, 12th, 13th, 17th, and 18th; L on 25th, and TS on 30th at 11.20 a.m.

BRIDPORT.—Rain fell every day from the 15th to the end of the month; T and L on 2nd, 25th, 26th and 30th. Sharp frost on the 17th, icicles hanging outside the window at 8 a.m. on 17th. South-westerly gales on 1st, 2nd, 4th, 21st to 26th, and on 30th. On the 23rd it blew a hurricane, and sea was fearfully rough; four vessels wrecked in the bay on the 24th and 25th. Fine lunar rainbow at 10.45 p.m. on the 9th; no meteors seen.

SHIFFNAL.—Rain still; only six days without, and daily from 13th to 30th, inclusive. Mild the first nine days, with S.W. wind, then cooler till 18th, with wind N.W., when S.W. again till the close. Heavy storm from S.W. at 5 p.m., and all night on 6th, and again on nights of 23rd and 25th, although frost on six nights not hard enough to cut down geraniums, &c. Only one degree difference between night of 24th and day of 25th, viz., 41°, 42°; great fluctuation throughout of the bar.; on the 30th 28·35 in., nearly reaching the fall of Jan. 24th, when it fell to 28·22 in., no strange result followed; great display of meteors on 27th from 6 to 8 p.m. when clouds hid them.

ORLETON.—Another rainy month; the land very wet, and the rivers greatly flooded during the last fortnight. Very little wheat has hitherto been planted. Temp. high till 9th, then cold to the 20th, afterwards warm to the end of the month; mean temp. about 2°·5 above the average; every frost followed by R; L frequently seen at night; distant T on 1st, 2nd, 8th and 30th. Violent winds on 6th, 13th and 23rd; bar. frequently very low, at 9 p.m. on 30th at 28·48 in. A shower of meteors after dark on the 27th, visible at intervals through openings in the clouds (which generally covered the sky) appearing chiefly to start from a point to the E. of the Pole star.

WIGSTON.—The saturated state of the earth has much retarded agricultural work. The temp. above the mean of a number of years; as compared with Nov., 1871 the Nov. of this year shows a mean of 6°·5 higher.

BOSTON.—An excessively stormy, wet month, at least eight heavy gales, principally from S.W., wind blowing on twenty days from that quarter. A very heavy N.E. gale on 13th and 14th, bringing unusually high tides; wind force 2·1 above the average (1 to 12); bar. ·35 in. less pressure than average, saturation 1·4 above the average; much land under water, and the sowing of wheat and other farming operations greatly impeded. The total rainfall for the eleven months ending November 30th, 29·61, being 9·63 above mean of previous ten years; taking the three autumn months the fall is 8·21, the greatest since 1852, when 11·05 fell.

GRIMSBY.—The weather fine for the season until 10th, when wet weather returned; much heavy land has not yet been sown with wheat. High wind on

2nd, 7th, 15th, and 24th. Gales on 6th, 23rd, and 26th, each continuing through the night; TS at 2.45 p.m. on 10th, and L at night on 25th.

MANCHESTER.—TS on 5th and 9th.

ARNCLIFFE.—Very wild night on 6th; hill tops white with S on 12th; heavy fall of S on 13th; falling stars on 27th.

N. SHIELDS.—Stormy on 1st, 7th, 11th, 13th, 23rd, and 24th; meteors seen on 27th; H on 12th and 14th; gale on 6th.

SEATHWAITE.—S on mountain tops on 14th; TS on 20th.

W A L E S.

HAVERFORDWEST.—One of the wettest and stormiest Novembers on record; very mild but stormy throughout; T, L, H, or R during the last fourteen days. Fearful gale on the night of the 22nd, many shipwrecks; very stormy period from 25th to 30th, with remarkable barometric depression; gale on 1st, and 9th (with tremendous squall at 11 p.m.); first S on the hills on the 11th. 40 in. of R fell in thirty minutes on the 21st, commencing at 11.40 a.m.

CEFNFAES.—A wet month, temp. low, violent winds, chiefly S.E.; on 23rd and 24th very high winds from S.E., and on the 23rd 3.10 in. of R fell in five hours, viz. 6 to 11 p.m.

LLANDUDNO.—S on the hills on 12th and till the 24th. Heavy gale with very vivid forked L on morning of 23rd, and also on the 25th; brilliant display of meteors on 27th, commencing at six p.m.; a very fine meteor at six p.m. on 28th, breaking into sparks.

S C O T L A N D.

DUMFRIES.—The first week wet and stormy; from 10th to 16th, fine, with frost; 11th, much S on the hills; from 17th to end of the month wet and stormy. A magnificent display of meteors on Wednesday evening (27th). The rainfall is 1.59 above the average of the five preceding years. Mean temp. 42.81 or 40.48 above the corresponding month of last year.

HAWICK.—The wettest month (excepting July) that we have had here this year. Very stormy on 1st, 5th, 6th, 7th, 8th, 15th, and 23rd. The hills were white with S on the 14th, but the month has been a very open one. Beautiful meteor seen moving westwardly on the night of the 2nd, and on the night of the 27th there was a grand display of falling meteors.

AUCHENDRANE.—L on evenings of 8th and 25th; gales on 6th, 21st, and 23rd. Bar. stood at 28.46 in. on evening of 23rd; hard frost on eight mornings and nine evenings; river in flood all the month. Meteors seen on the evening of the 27th.

NOOKTON.—Gale on 5th and 6th; meteors on 27th, six to eight p.m.

CASTLE TOWARD.—A very dull month, with some extremely wet days; on the 5th between 8.30 a.m. and 5 p.m. 1.40 in. fell. On 10th heavy gale on sea and land, doing much damage, turning over corn and hay-stacks, as well as uprooting hundreds of forest trees. Hill tops covered with snow on the 10th. On the whole a very uncomfortable month for out-door labour; great fall of meteors on 27th.

DEANSTON.—More rain in this month than any previously this year; from 10th to 15th comparatively dry, some frost, and slight shower of S on 13th; gale on 10th, and a great display of meteors on evening of 27th from five to ten p.m.

ABERDEEN.—A mild but dull, stormy, and remarkably wet month. Auroræ on ten nights; L on 7th; meteors at six p.m. on 3rd, and a remarkable display of them from 5.30 to 11 p.m. on 27th.

PORTREE.—A wet, stormy month; strong gale from W. from 8 p.m. of 5th to 7 a.m. of 7th; from 10.45 p.m. of 6th to 12.30 a.m. of 7th it equalled in force the great gale of October 3rd, 1860. Fine lunar rainbow on the 11th, all the colours distinct; frost from 12th to 19th and 28th to 29th, with slight fall of S on the high ground. A grand display of shooting stars all the evening of 27th.

SANDWICK.—Wetter and colder than the mean (of forty-five years); bar. very low, standing below 29.00 on six mornings, and on six nights and on the night of 23rd lower than it had been since January, viz., 28.468; frequent auroræ and rainbows; a gale of 45 miles per hour from 4 a.m. till 4 p.m., and 55 miles per hour from 9 to 10; Iris, TS, and auroræ all on this date, the 7th.

IRELAND.

WATERFORD.—20th and 21st, 23rd and 24th stormy ; 27th numerous meteors (showers) proceeding from zenith in all directions towards the horizon, but most towards the W., from 5.30 to 8 p.m.

MONKSTOWN.—An unusually wet month, not so much as regards any one day's rainfall (though there was 1.04 in. in about twelve hours on the 22nd) but its constancy, few days passing without more or less rain. Bar. 28.59 in. on 23rd, and 28.60 on 30th (uncorrected).

DOO CASTLE.—A storm on 6th, trees snapped and uprooted, stack of corn blown down, and a few houses thrown. No rain from 8th to 16th, rest of the month very wet. Meteoric shower on night of 27th. Potatoes not all up yet.

WARINGSTON.—Wet and stormy, ground perfectly saturated, and all farming operations quite suspended. A tremendous gale from W. to S.W. on the afternoon of the 6th, supposed to be unequalled since July 7th, 1839, temperature in the forenoon unusually high ; a number of very large elms blown down.

THE COMING WINTER.

To the Editor of the Meteorological Magazine.

Sir,—According to several laws which appear never to have failed, the coming winter must be, on the whole, a mild or nearly a medium one. In fact it seems that a really long and severe winter is impossible this season. In the latter half of December, 1871, and in the mild winter quarter (January, February, and March) of 1872, we had very few intervals of frost. I expect more in the corresponding periods of the coming season. One of these intervals of sharp frost should occur in the early part of February, and it seems almost certain that the mean temperature of this month (February, 1873) will be below the Greenwich average of the last 50 years.

The principal law on which my prediction for the coming winter is founded, is the converse of that stated in your magazine for December, 1870, page 195, and may be briefly stated as follows :—When the Greenwich rainfall of the first seven months of the year has been large (say 14 inches or more), the mean temperature of the following December to February (inclusive), is in excess of, or about, the average, unless the mean of August to October (inclusive), has been remarkably cold, as in 1860.

GEORGE D. BRUMHAM.

Barnsbury, November 30, 1872.

PRESTEL'S HYGROMETER.

To the Editor of the Meteorological Magazine.

SIR,—In reference to the atmometer described in your August No., there appear to be some defects in Prestel's apparatus which must render it useless as a correct measure of evaporation, if I understand it. In the first place the dish being exposed, the water would be taken by the birds, also, in a high wind the water would be liable to be driven over the sides of the dish, and if not splashed over, would wet the sides and cause an extra evaporating surface.

These two objections might be obviated, but the most decisive argument against Prestel's apparatus is, that the atmospheric pressure would affect the water in the gauge and keep it permanently up to the top of the tube, under any circumstances whatever.—I am, Sir, yours respectfully.

HENRY DAVIS.

Derby.

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

LXXXIV.]

JANUARY, 1873.

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WEATHER MAPS OF THE NORTH ATLANTIC.

WE assign to the work mentioned below,* a somewhat prominent notice because we are inclined to class it as the best work that the Meteorological Office has yet issued. Our readers will remember that the "City of Boston," a well known and fine vessel, left Halifax, Nova Scotia, on January 28th, 1870, and has not since been heard of. In the present monograph, Captain Toynbee, the Marine Superintendent of the Meteorological Committee, has collated a very large mass of information from every accessible source, and has given a series of charts of pressure, wind, and weather over the Atlantic of great value,—all the greater because accuracy in drawing the isobars is not sacrificed to pictorial effect. The monograph embraces the period from Jan. 28th to Feb 8th, and gives ample details of the weather in which the ill-fated vessel was lost; and when we mention that the standard barometer on board the "Tarifa" in 51°N. and 24°W. read 27·33 in. at the same time as the pressure at St. Petersburg was 30·99 in., we need probably say nothing more to induce our readers to peruse for themselves the lucid accounts laid before them.

There is one reflection which will occur to every one:—Why should we not have such charts for every day in the year?—why do the Meteorological Committee cramp their action, and dwarf their position, by coquetting with English private observers, and neglect the splendid opportunity (which is legitimately their own) of searching on the bosom of the broad Atlantic,—the birthplace of British storms, the ruler of British climate—for that knowledge of coming storms and future weather which we believe would inevitably reward researches conducted in the frank and thorough manner of the work which has led to these remarks.

•

* *A Discussion of the Meteorology of the part of the Atlantic lying North of 30° N. for eleven days, ending Feb. 8th, 1870, by means of Synoptic Charts, &c.* [Published by authority of the Meteorological Committee.] London: Stanford, 4to., 164 pages, and Atlas of Charts.

PLANTS SEEN IN FLOWER 10th JANUARY, 1873, AT FERNHURST, SUSSEX.

Scarlet rhododendron, erica carnea, stock, wallflower, primrose, snowdrops, crocus, Christmas rose, violets, gorse (plentiful). Three roses: viz., Prince of Wales, monthly, Gloire de Dijon. Ragwort, daisies, buttercups. Geraniums unhurt but not in flower, calceolaria quite green.

HEAT AS INDICATED BY NATURAL *v.* ARTIFICIAL MEANS.

To the Editor of the Meteorological Magazine.

SIR,—I have heard it said that it is a characteristic of Englishmen to give everything a fair chance of success. However, no one, I imagine, will hesitate to make a fearful exception of Mr. Robson's new cereal system of measuring heat and cold. Concurring, as I heartily do, with Mr. Crallan in his view of one of the principal uses of the thermometer (p. 195), I cannot see how Mr. Robson's system will work. How are we to get at the greatest summer heat or the greatest winter cold of various localities? Take two places pretty much on the same parallel, Hereford and Ipswich. Suppose that, in a certain year, the commencement of harvest was later by a few days at Hereford than at Ipswich, are we necessarily to infer that the growing and ripening period was cooler at Hereford than at Ipswich? I do not think so. An extra week of rain at Hereford, occurring at the end of this period, might perhaps account for the difference—inferior farming at Hereford might account for it—scarcity of hands at Hereford might account for it. The maximum shade temperature of the period might be (say) five degrees higher, and the mean shade temperature thereof (say) half a degree higher at Hereford than at Ipswich, yet Mr. Robson's system would not be able to tell us so positively. Quite the reverse. But what do I know of these things, am I not a *London* correspondent? (Here I may as well inform Mr. Robson that I have passed twenty-four years of my life in the country.)

In re damp cloths. I have no doubt that if Mr. Robson would take the trouble of placing a really *good* thermometer by the side of his moist dusters, he would arrive at results by no means confirmatory of his opinion of our present instrumental system. Let him, however, beware; nature is sometimes as treacherous as art. I have seen cloths "stiffened" by *dryness* as well as by frost; and with the temperature at about 32°, and without a thermometer, will he undertake in every case to decide between the two?

Adverting to my letter of the 18th of October last, I should like to hint once more to Mr. Robson that it is not quite logical, after describing our present thermometric system as practically next to useless, to propose to employ it in support of his views. This is bad enough, but he goes a step further; as long as the instruments conduct themselves

in a becoming and gentlemanly manner, and do not rudely contradict his statements, he is satisfied, if, on the other hand, in the interests of science, they should presume to assert a different opinion, "then some further inquiry ought to be instituted!" Really, this will not do.

In conclusion, I think it would more become us, as meteorologists, to discuss the points raised in Mr. Crallan's letter, and leave the Robsonian system to its fate. Like floral horology, it may be interesting, but it certainly is not practically useful. I leave the field to Mr. Robson, not because I am beaten, but because Mr. Robson like the British at Waterloo does not know when he is defeated.

Remain, Sir, truly yours,

E. G. ALDRIDGE.

3, Bonny-street, N. W., 18th Dec. 1872.

P.S.—As to frost, see Mr. Prince's letter on p. 72 of Vol. III. of the *Meteorological Magazine*.
E. G. A.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Robson has again (in your last number), made several mistakes and misrepresentations. Permit me to call attention to some of them. (1.) Sarcasm uttered at the expense of accuracy is never effective. In the sneer with which Mr. Robson opens fire on me this is exemplified. He represents that I waited till the summer was over before speaking of the time of its commencement. This is by no means strictly correct. In your magazine for December, 1871, I specified June to August inclusive, as the Greenwich period of my predicted high summer mean temperature. The mean of that period at Greenwich was as much as 1°·6 hotter than the average of 101 years. I think all your candid readers will admit that this was a sufficiently striking fulfilment of a sufficiently explicit forecast. Even Mr. Robson will not venture to say that December, 1871, occurred *after* June, 1872. My laws now foretell a warm or cold summer or winter, with absolute certainty to within a week or so. I think these are steps in the right direction. The refinement of calculation Mr. Robson recommends is beyond my ambition. Forecasting the commencement of a hot summer to "the precise day, hour, and minute" is nearer perfection than I ever hope to reach. I have, however, the fullest confidence, (as I stated in the *Gardeners' Chronicle* in April last), that whenever the Greenwich mean temperature of the period from the middle of February to the middle of March is above 44½ degrees, we shall have, *as we always have had*, a very hot summer. It may begin before June, as in 1846 and 1868, about the 7th or 10th of June as in 1826 and 1859, or a few days later as in 1872, that is of little consequence, but a remarkably hot summer we certainly shall have in these parts; and here let me remark that my predictions were never intended to apply to a mountainous country like Wales. They apply to England only, and to the south-east of England especially. (2.) Mr. Robson says, "In a former number of the *Meteorological Magazine* Mr. Brumham tells us it has been a hot summer and a wet

one, by which I comprehend he means a greater amount of solar heat and greater rainfall in the 97 days than is usually the case." What I really did say about the wet was almost precisely what he suggests as an explanation of my meaning. It was:—"At your station the rainfall has been somewhat in excess of the average, and at very many stations the summer rainfall has been excessively large." So the effort to "comprehend" was wholly unnecessary. With regard to "solar heat" I trust Mr. Robson will pardon me for suggesting that his comprehension still appears somewhat confused. I did not allude to solar heat at all, because I was not sure that we had very much of it last summer. In my letters I wrote exclusively about "shade heat" and the "true mean temperature of the whole 24 hours." This obviously includes night as well as day temperature. Now as we do not expect to be favoured with sunshine in the middle of the night, your correspondent ought to perceive that I could not have referred to solar heat. (3.) With regard to the rainfall of last summer Mr. Robson appears to be similarly confused. Because I predicted excessive rains for that season, he strives to make more than three months of it appear dry. He really seems to spare no means, fair or unfair, to depreciate a hard-working labourer in the field of predictive Meteorology. He appears, however, to get sadly bewildered in the effort. For instance, at lines 7 and 8 from the bottom of page 192, he admits that the rainfall of my summer period was greater than the average as a "rule," and confirms this admission in the line below by stating that Linton was an "exception" to that rule, but at lines 11, 12, and 13 from the end of his letter he seems to consider weather "prophecies" additionally discredited because my summer forecast (as he states) did not apply to his exceptional station. In fact, because it only agreed as a rule, but did not apply to the exception. This is rather peculiar logic. (4) In your magazine for October last, page 160, Mr. Robson shows that his rainfall table extends as far back as 1855. In your last number, page 193, he tells us that his mean of the 97 (summer) days referred to in the 16 years from 1856 to 1871 inclusive, was 6.66 inches, and the rainfall for the same period last summer 6.34 inches. This shows a difference of about three-tenths of an inch,—not enough, one would think, to constitute last summer a dry one at Linton. Your readers will perceive that Mr. Robson includes the year 1855 in your October number, but "adroitly" suppresses it in his last letter. It is not necessary to go far for a reason. The months of June, August, and September were remarkably dry in 1855. By excluding that one summer the mean rainfall is made to appear about one-tenth of an inch greater than the true mean of Linton. This doubtless appeared an important difference to Mr. Robson. If he had in a fair and honest way taken his real mean—the mean of 17 years—instead of "adroitly" leaving out just the first year of his series, it would have shown the rainfall to be too near the actual mean, (as it really is) for last summer to be considered a dry one at Linton. His elaborate arguments to prove that the 97 days were dry, would then have seemed (as they certainly are) value-

less. It is possible that a "discerning public" to whom Mr. Robson appeals, may consider a treatment of figures, which among accountants would be designated "cooking," as somewhat unworthy of one who professes to give reliable reports of the weather. They may also think that even a predictive meteorologist (who has literally used millions of figures in deducing certain weather laws), is entitled to a little fair play. Your correspondent will perhaps complain because I have made the above statements, or possibly he will find it convenient to dismiss the subject with a sneering commendation of my "guessing," but he will not be able to deny that the "adroit" exclusion of 1855 made an appreciable difference in his Linton mean to my disadvantage. Complaint, however, is not argument, neither is a sneer equivalent to a proof. A complete and accurate statement of facts is far preferable. Even if his only desire is to depreciate weather prophecy, the latter course is more likely to be successful than the former.

Plants cannot inform us of the maximum, minimum, or mean temperature of the day, and the commencement of wheat harvest is affected by so many retarding influences as to be practically worthless for indicating the heat of a season.

In my last letter I expressed a belief that the mean temperature of July, 1872, at Linton, was about one degree above the 17 year average, and asked Mr. Robson to kindly furnish us with those means for the purpose of comparison. I prefer figures to "guessing," but as I had not the former, I tried the latter, and think a "discerning public" will see that I must have guessed correctly. Mr. Robson declines to oblige by producing the figures asked for. A desire to avoid still further exposure of his error with regard to the heat of July last, is doubtless the only reason why he has deviated from that obliging courtesy, for which I believe he is ordinarily so distinguished. As his present discourtesy is probably the result of this very excusable weakness, I suppose we must not say much against it.

GEORGE D. BRUMHAM.

[This correspondence must be less discursive, more meteorological, and more condensed, or we shall be obliged to terminate it. We fully recognize the ability of the writers, and the importance of many of their remarks, but we are also aware that much space would have been saved had plain answers been given to plain questions, and all fencing been avoided. Moreover, two distinct subjects have been mixed up together, to the prejudice and injury of both. We venture to suggest that should any further communications be forwarded they should be separate letters on "The Summer of 1872," or on "Heat as Indicated by Natural Means."—ED.]

SUN SPOTS AND CYCLONES.

To the Editor of the Meteorological Magazine.

SIR,—I mentioned to you that I am strongly of opinion that the solar spots surpass the photosphere as much in "heat-radiation" as they are deficient in luminosity. Brewster ("Astronomy," in *Edin-*

burgh Encyclopædia) held a somewhat similar view. I forget his reasons, but it is obvious that great increase of rainfall in temperate climates indicates more than ordinary evaporation in tropical waters, which it may be possible to connect with "spot-radiation."

The rainfall in a limited region (as in the British Isles) would, I suspect, be wholly inadequate to prove anything, but when, as in this year, great floods have prevailed not merely in our own islands, but in Belgium, France, Denmark, Switzerland, and Italy also, the question of the cause of such uncommon evaporation can no longer be neglected by meteorologists.

To such increase of evaporation I have no doubt we owe also the prevalence of cyclonic storms, which are, I think, easily accounted for. Let us imagine a rapid current of air (say a 1000 ft. in depth), at a temperature of 80° Fahr., and loaded with moisture, moving from the tropics, and meeting with a cold current (at 30° Fahr.) proceeding from the Pole towards the Equator, and we may assume the medium temperature (55°) to be that of any condensed vapour. But 1000 cubic feet of vapour at 80° weighs 11,000 grains, while the same volume at 55° weighs only 4,900 grains, consequently the difference, (6,100 grains of vapour) must be condensed in the mixed column of 2,000 cubic feet, or 3,050 grains of vapour in 1,000 cubic feet. When we multiply this quantity of vapour by 1,075 (its latent heat at 55°), we obtain (as an equivalent) 3,278,750 grains of water, and dividing this by 540,864 (the weight of 1,000 cubic feet of air), we obtain 25½ as the number of degrees (above 55°) by which the temperature of the column of air must be increased on the condensation of the vapour due to the intermixture of the two currents.

The air, thus heated, must *ascend* rapidly, and produce a comparative vacuum, towards which the external air must of course press in everywhere, and as the vacuity is, generally, a "large moving *area*" (not a *centre*), the in-rushing streams must clash, and (in connection with the effect of the earth's rotation) produce the vortex which, combined with excessive rainfall, is especially characteristic of cyclones. I fear this year will be found, like 1830-31, to be very disastrous to sheep-farmers, especially in low lands, from liver disease (rot), consequent on the excess of rain. In seeking for sun-spot influence, the EXTENT of spot surface, rather than number or frequency of new spots, ought to be kept in view.

Yours faithfully,

HENRY HUDSON.

Glenville, Fermoy, 24th Dec., 1872.

SHOWER OF METEORS.

SIR,—Since writing you under date November 30th, I have ascertained from two independent witnesses, whose accounts agree, that at about 6.0 p.m., there appeared in the west, but not far from the zenith, a large bright meteor, which continued for half a minute, and left behind it a luminous track, which one of my informants compared to "a shower of fine white sand, which finally took the shape of a

triangle, in which form it remained fully eight minutes." At about 7 p.m. the shower of meteors began, and according to the same informant, "at about 7.40, the whole heaven appeared illuminated; the stars were shooting in all directions, it was quite impossible to count them." The shower after this continued, though perhaps less brilliantly, far into the night. My own observations from 10.30 you have already received.

Yours truly,

H. A. BOYS.

Patras, Greece, Dec. 7th, 1872.

[The following letter to Mr. J. F. Bateman, C.E., F.R.S., has been by him kindly placed at our disposal, and will we are sure, be read with pleasure and profit.]

SIR,—I beg to send you a few notes on the shower of aerolites I witnessed on the night of Wednesday, 27th inst., thinking it possible they may be of some interest to you and to your astronomical friends.

I arrived at La Puebla about 6.30 p.m., from Palma, and up to this hour the heavens presented their usual aspect, the night being extraordinarily serene and not a cloud visible, but on leaving my house about 8.30 to visit a sick friend, my attention was immediately arrested by the multitude of falling stars. I hastened to a somewhat open space, where the view south and east reached nearly to the horizon, and was also pretty fair due east, and for half-an-hour watched this phenomenon with much attention, the result of my observations being as follows:—

Number and frequency.—Greater number falling both in N.E. and S.W., looking due S. with eyes fixed at an angle of about 40° with horizon, no three seconds passed without an appearance, and frequently five or six aerolites were falling simultaneously in the field of view. I should say that at least fifty were occasionally visible at the same moment throughout the heavens.

Brilliance.—Very variable; some were brighter than any fixed star, and others so faint as to be scarcely perceptible.

The light of all appeared quite white, and many were followed by a faint train of light, others, towards the end of their course, carried a small bright cloud or tail after them of considerable width, which was momentarily visible after the extinction of the nucleus.

The brightest generally seemed to be those which came into view at a vertical angle of from 40° to 50° , those which made their appearance very high or low being the faintest.

Direction of fall.—In whatever direction I looked their fall appeared quite perpendicular to the horizon, with one exception. In this case the aerolite appeared at an elevation of about 25° nearly due east, and pursued a course towards south, forming an angle of about 10° with the horizon through an arc of about 25° or 30° .

Three similar exceptions, pursuing the same direction, were seen by my inspector, Niclos, in Alcudia.

Vertical position of visible course.—They came into view at all elevations, from 20° upwards, but my impression was that the greater

number appeared at an elevation of from 45° to 60° , and that the length of illuminated course varied from 5° to 15° .

Duration of illuminated course.—My impression was that no aerolite was visible during more than one and a half second, and the majority not more than one second.

Duration of shower.—At 9.40 p.m. the aerolites were far less frequent, but even at 5.30 a.m. on Thursday, a considerable number were still falling. On the succeeding night I watched for some time and saw none.

The master of a vessel belonging to Alcudia was becalmed just off the harbour of Barcelona on the evening of the 27th, and he watched the shower until 12.0 p.m.; he describes it as a rainfall ("lluvia") of stars. It began at 6 p.m., the first appearing in the north, and by 6.30 p.m. they were falling all around the horizon; he observed that their fall was quite perpendicular. He called up his father, a very old sailor, to see the sight, and the latter observed that he had never seen such a multitude of falling stars.

I am unable to say whether the temperature was altered during this phenomenon, as there is often a great difference between Palma and Alcudia, but it certainly was very chilly on this night. A breeze from the south set in during the night, and continued slightly increasing until Saturday morning, when it blew half a gale. The barometer commenced falling also on Wednesday night, and up to Saturday morning had fallen 0.47 in., and now at 9 p.m., it is a tempestuous night.

Yours faithfully,

HENRY R. WARING.

La Puella, Majorca, 30th Nov., 1872.

DAILY VARIATION IN THE PREVALENCE OF RAIN DURING DECEMBER.

THE depression whose advance on our coasts had produced so much rain on the 30th November, lay over the S.E. of Ireland, at 8 a.m. on the 1st. The winds circulating round it were light, but a slight further fall occurred in most places, followed by the total break-up of the system. A change now occurred. At 8 a.m. on the 3rd, a complex depression appeared over the W. and N. of France and while the S.W. winds on its southern borders brought heavy rains to the south of France, the northerly breezes felt over our islands produced showery weather in the south of England, and some rain in Scotland. During the 4th, however, the mercury rose very rapidly over the Bay of Biscay, so that on the 5th high pressures were found there, producing variable winds and fine weather in the greater part of our Island, but restoring the southerly current with heavy rain in Ireland. This was only the forerunner of a very serious disturbance, which thrust itself over the N. of Scotland on the 6th, and after producing more or less rain on all parts of our Islands travelled towards Scandinavia. The temporary cessation of rain which apparently would have been experienced in the S. as the storm passed off was prevented; for during the

night of the 6th, a local disturbance rapidly passed up the English Channel, and lay over Belgium, at 8 a.m. on 7th heavy rainfall was thus experienced. The morning of the 8th found the weather finer generally, but night brought a new depression of small extent to us, which crossed directly over the country from the W. S. westward, accompanied by severe gales and heavy rain. This was followed on the 10th by a fresh storm, whose centre crossed France, and while heavy rains were experienced in that country, N. westerly breezes with snow and hail were reported from most of our stations. All passed off on the 11th, and the morning of the 12th found pressure uniform in the British Isles. The western barometers were, however, again falling, and rain once more set in, except in the north-east of the country. In the night of the 13th, a new small depression advanced to the position of the Scilly Isles, bringing south-westerly winds to the Bay of Biscay, and south-easterly breezes to our coasts. In the north the weather improved, but both on the 13th and 14th, (during which time the central area travelled very little), rain again fell in the southern districts and over France. On the morning of the 16th, the mercury had descended suddenly at our N.W. stations, while it rose in France. In the night a well defined depression travelled over our N.W. coasts, and continuing its journey was found over Norfolk next day. To the northward of its track very heavy snow storms occurred, completely interrupting telegraphic communications with many parts of Yorkshire, while heavy rains occurred in its southern parts. During the 18th, the system broke up, and from the 19th till the end of the month, a series of disturbances passed along our western coasts, and (except some few intervals of finer weather at our southern and eastern stations), rain was the prevailing feature of the weather everywhere.

F. G.

THE GALE OF SUNDAY, DEC. 8TH, 1872.

SEA LEVEL PRESSURES AT CAMDEN SQUARE.

Time.	Pressure. Inches.	Time.	Pressure. Inches.
Dec. 8th 5 0 p.m.	.. 29·041	Dec. 8th 9 30 p.m.	... 28·734
— 6 0 „	.. 28·926	— 9 45 „	... 28·732
— 6 15 „	... 28·899	— 10 0 „	... 28·734
— 6 30 „	... 28·866	— 10 15 „	... 28·733
— 6 45 „	... 28·871	— 10 30 „	... 28·742
— 7 0 „	... 28·859	— 10 45 „	... 28·742
— 7 15 „	... 28·841	— 11 0 „	... 28·750
— 7 30 „	... 28·821	— 11 15 „	... 28·740
— 7 45 „	... 28·816	— 11 30 „	... 28·745
— 8 0 „	... 28·794	Dec. 9th 0 0 a.m.	... 28·738
— 8 15 „	.. 28·786	— 1 45 „	... 28·734
— 8 30 „	... 28·774	— 6 15 „	... 28·790
— 8 45 „	... 28·754	— 7 15 „	... 28·820
— 9 0 „	... 28·750	— 9 15 a.m.	... 28·907
— 9 15 „	... 28·740	— 9 15 p.m.	... 29·023

G. J. S.

Readings of Barometer, corrected and reduced to 32° and sea level, at Merton Villa, Cambridge.

1872.	Inches	1872.	Inches
Dec. 8. 9 0 a.m.	... 29·51	Dec. 9. 8 10 „	... 28·86
— „ 8 15 p.m.	... 28·86	— „ 9 15 „	... 28·91
— „ 9 30 „	... 28·79	— „ 2 0 p.m.	... 29·07
— „ 11 0 „	... 28·78	— „ 6 0 „	... 29·11
— 9 0 0 a.m.	... 28·74	— „ 8 30 „	... 29·13
— „ 0 45 „	... 28·73	— 10 0 30 a.m.	... 29·14
— „ 1 15 „	... 28·72	— „ 9 0 „	... 29·14
— „ 2 30 „	... 28·72	— „ 3 0 p.m.	... 28·94
— „ 3 45 „	... 28·72	— „ 6 0 „	... 28·87
— „ 4 45 „	... 28·72	— „ 9 45 „	... 28·89
— „ 6 0 „	... 28·79	— 11 0 30 a.m.	... 28·98
— „ 7 15 „	... 28·83	— „ 9 0 „	... 29·34

REMARKS.—Dec. 8. Sky clear, moderate air from W.S.W., at 1 p.m. Cloudy by 3 p.m. Heavy rain, wind rising fast from S. at 5.30 p.m. till 7 p.m., heavy squalls from 7 till 9.30., violent gale with heavy showers at intervals from 9.30 p.m. till 4 a.m. (9th), gale continued till 8 a.m.—Dec. 9. Evening and night clear, calm and frosty.—Dec. 10. Rain with brisk wind from N.N.E. from 4 p.m. to 10 p.m.—G. WARREN.

SIR,—I annex barometrical readings, corrected, but not reduced to sea level :—

Dec. 8th	.. 9 a.m.	... 29·300
„	... 7.30 p.m.	... 28·456
„	... 8 p.m.	... 28·415
„	... 9 55 p.m.	... 28·425
Dec. 9th	... 9 a.m.	... 28·830

The gale went on increasing in fury as the barometer rose. The weight of the storm was felt at Hereford chiefly from 10 p.m. to 3 a.m. My vane, which has weathered many heavy gales, was blown away. The strong mast, firmly fixed and supported by stays of galvanized iron wire, was thrown down on the roof, and kept from falling to the ground only by the lightning conductor; the vane, however, a tolerably heavy one, came to the ground.

Yours, &c. E. J. ISBELL.

SIR,—I thought you might like to hear a short account of a most fearful gale which raged over our town for 6 hours yesterday, 4 to 10 p.m., and I think it was a heavier gale than I ever knew before, much heavier than the gale of the 23rd November. Yesterday (the 8th) the morning broke fair with rather a rough wind, barometer (Fitzroy's) at 29·60 at 9 a.m. At 1 the wind began rising and at 3.30 p.m. blowing a strong gale. At 4.30 one loud peal of thunder accompanied with vivid lightning, barometer at 29·15. The gale increasing in violence, blowing in furious gusts. It continued blowing about every 5 minutes with the force of a hurricane till 9 p.m., barometer at 29·00 the lowest reading. I think the hardest part of the gale was at between 7 and 8.30, when it made the houses shake; slates blew about in all directions. At 10 p.m. the wind abated (or rather from 9·30) barometer having risen to 29·10. Several large trees were blown down in the outskirts of the town, one in the field adjoining my house. A chim-

ney stack fell through the roof on a bed in one of the houses in the town, and at my mother's house, close on the outskirts of the town, the whole chimney stack was blown down, and one complete frame in the green-house was whirled out and blown about 30 yards on the lawn. Maximum temperature of the day 51°, rainfall 0·29 inch. No doubt I shall hear of great damage in the neighbourhood.—Yours, &c.,

ALFRED STEPHENS.

Bridport, December 9, 1872.

SIR,—A very sudden fall of the barometer occurred yesterday, amounting to ·58 in. between 2 p.m., and 6·45 p.m. From the sub-joined tables it will be seen that the fluctuations were very remarkable, especially between 6·45 and 9 p.m.

8th, 9	a.m. ...	...	...	29·43 in.
2	p.m. ...	...	..	29·36 „
4	„ ...	...	...	29·19 „
5	„ ...	...	...	29·07 „
6	„ ...	...	...	28·95 „
6·20	„ ...	...	...	28·90 „
6·45	„ ...	...	...	28·78 „
7	„ ...	...	...	28·80 „
7·45	„ ...	...	...	28·72 „
9	„ ...	..	...	28·80 „
10·30	„ ...	...	...	28·75 „
11	„ ...	...	...	28·74 „

At 7 a.m. on 9th the barometer had risen to 28·81 in.—Yours truly,
THOMAS PAULIN.

Winchmore Hill, Dec. 9th, 1872.

SIR,—We had a very sharp short storm here yesterday afternoon, with lightning. Barometer fell rapidly, till about 6·45, when it stood at 28·915 *reduced*. Rain ·29 in.—Yours truly,

W. T. RADFORD.

Sidmouth, Dec. 9th.

SIR,—This storm does not seem to have been of so violent a nature here as elsewhere in Ireland, but especially in England. Yet, although not destructive in its effects it was most interesting in its phenomena. The weather was moderate, yet threatening, in the morning, but the wind freshened gradually, and came on to blow hard, with rain from S.S.E. about 11 o'clock, increasing in violence up to about twenty minutes before two, when, with a furious squall, almost amounting to a hurricane, but of short duration, and accompanied by a heavy hail shower, it fell suddenly calm. After a calm interval of about an hour, when the sun came out, the sky became overcast again (the wind blowing from N.N.W.), and gradually freshening into a gale, which blew with great violence from the same quarter, accompanied by heavy rain, up to 9 p.m., when it moderated.

The barometer ranged from 29·20 at 9 a.m., to 28·31 at 1·40 p.m., when it began to recover itself, and rose to 28·90 next day. The maximum and minimum range of the thermometer in the twenty-four

hours ending 9 a.m. on the 9th, were 40 and 28. The rainfall in the same period was .73. From the above data it would appear that the storm was a cyclone, and that its centre passed over the county of Kilkenny about 2 p.m., on the 8th, travelling from N.N.W. to S.S.E.

Yours, &c.

JAMES GRAVES.

Inisnag Glebe, Stonyford, Co. Kilkenny.

N.B.—Neither the barometric nor thermometric data are corrected.

READINGS (CORRECTED) OF BAROMETER AT HAVERFORDWEST.

Dec.		Inches.	
8th...	9 a.m. ...	29.461	Showery, heavy squalls with rain.
— ...	2 p.m. ...	28.996	Fearful squall of hail and rain, wind rising to full gale.
— ...	3 „ ...	28.889	Sheets of water descending from 2 p.m.
— ...	4 „ ...	28.771	to 4 p.m. .82 in rain fell.
— ...	5 „ ...	28.687	Force of gale increasing heavy squalls.
— ...	6 „ ...	28.590	Storm tremendous, houses unroofed.
— ...	7.30 „ ...	28.562	Large trees uprooted, rain ceased.
— ...	8.30 „ ...	28.631	Wind shifting, squalls terrific.
— ...	9.30 „ ...	28.685	Wind suddenly shifted from S.S.E. to W.
— ...	10.30 „ ...	28.784	Blowing fearfully from W.N.W., the night.
— ...	11 „ ...	28.820	Terrible storm, less violent after midnight.
9th...	9 a.m. ...	29.061	Blowing very fresh.

This gale is supposed to have been the heaviest that has occurred here since October 1859, when the "Royal Charter" was lost.

E. P. PHILLIPS.

SIR,—My anemometer, on a pole 20 ft. above the surface of the earth (as represented in the frontispiece to *British Rainfall*, 1868) indicated a horizontal motion of 433 miles between 9 a.m. on Dec. 8th and 9 a.m. on 9th.

Yours, &c.

C. H. GRIFFITH.

Strathfield Turgiss Rectory.

SIR,—It may interest you to know that we have had an extraordinary fall in the barometer, yesterday morning the corrected reading at 9 a.m. was 29.185, wind W. by N., with a clear bright sky. Dry bulb 41°·4, wet 38°·8. Between 4 and 5 p.m. the clouds began to gather, wind S., barometer falling,—the lowest observed point being at 11 p.m. 28.42, (corrected),—it was the same at 5.45 this morning and had recovered at 9 a.m. to 28.521, wind W. by N., it blew pretty fresh during the evening, but nothing like a gale. Rain commenced about 7 p.m. yesterday and this morning I measured 0.50. Dry bulb 37.3, wet 36.2. Rainfall this month 1st to 8th inclusive, 0.75.

Yours truly,

A. ATKINSON.

Gainford, Dec. 9, 1872.

SIR,—After an exceedingly rapid fall yesterday evening, the barometer at 11 p.m. was only 28.503, reduced to 32° at sea level, one of the lowest readings I have ever recorded here. The wind rose to a gale from S.E. last night, veering this morning to W.N.W., with heavy showers.—Yours truly,

BOSCAWEN T. GRIFFITH.

Trevalyn Hall, Wrexham, Dec. 9, 1872.

DECEMBER, 1872.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which ≥ 0.1 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.			Min.		In shade	On grass.		
				Dpth	Date.	Deg.	Date.		Deg.	Date.				
													inches.	inches.	in.
I.	Camden Town	4.35	+ 2.85	.81	16	22	54.6	22	26.6	12	5	6		
II.	Maidstone (Linton Park).....	5.26	+ 3.43	.65	17	25	56.0	22	26.0	5	5	...		
III.	Selborne (The Wakes).....	6.63	+ 3.88	.94	16	25	53.5	22	23.0	12	6	11		
IV.	Hitchin	3.78	+ 2.47	.90	16	25	50.0	22*	24.0	11	9	...		
V.	Banbury	4.00	+ 2.33	.93	16	25	51.0	22†	24.5	12	8	...		
VI.	Bury St. Edmunds (Culford).....	3.83	+ 2.34	.75	10	23	51.0	25	25.0	11	6	13		
VII.	Bridport	5.04	+ 1.67	.56	6	25	54.0	22	24.0	5, 12	4	...		
VIII.	Barnstaple.....	5.71	+ 2.59	.60	27	25	56.0	23	27.0	12	...	...
IX.	Bodmin	9.49	+ 4.25	1.91	27	25	53.0	22	32.0	5††	3	4		
X.	Cirencester	4.04	+ 1.75	1.13	16	25	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall)	3.71	+ 2.03	.94	16	21	50.0	23‡	23.0	5	14	...		
XII.	Tenbury (Orleton)	4.86	+ 2.40	1.27	16	26	53.8	23	23.0	5, 12	10	11		
XIII.	Leicester (Wigston)	3.13	+ 1.61	.80	16	23	51.0	22§	23.0	4	6	...		
XIV.	Boston	3.28	+ 1.79	.80	16	22	51.0	25	28.0	5	9	...		
XV.	Grimsby (Killingholme)	3.38	...	.87	16	23	51.0	22§	27.0	14	3	...
XVI.	Derby.....	3.78	+ 2.23	.92	16	22	52.0	23	26.0	5	8	...		
XVII.	Manchester	2.97	+ .64	.59	8	20	52.0	27	24.0	5	7	11		
XVIII.	York .....	...	...	...	...	...	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	6.01	+ 1.46	.85	28	23	47.0	27	20.0	12	10	...		
XX.	North Shields	4.46	+ 2.26	1.03	8	25	50.2	27	26.2	12	4	7		
XXI.	Borrowdale (Seathwaite).....	20.37	+ 3.42	2.70	27	21	...	...	...	...	...	...
XXII.	Cardiff (Ely)	7.57	+ 4.97	.99	17	22	...	...	...	...	...	...
XXIII.	Haverfordwest	9.99	+ 5.16	1.47	27	22	54.0	22	24.0	11	6	10		
XXIV.	Rhayader (Cefnfaes).....	9.66	+ 6.37	1.10	8, 16	25	51.0	...	21.0	...	...	...
XXV.	Llandudno.....	4.23	+ 2.03	.84	16	20	56.0	23	30.6	5	1	...		
XXVI.	Dumfries	5.25	+ 1.79	1.05	8	17	52.0	22	20.5	12	9	...		
XXVII.	Hawick (Silverbut Hall)	4.29	...	.90	8	25	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House) ...	5.19	+ 1.17	.70	7	18	52.0	5, 20	20.0	12	12	17		
XXIX.	Castle Toward	6.32	...	.95	6	17	52.0	23	...	...	7	...
XXX.	Leven (Nookton)	3.04	+ .26	.79	22	19	53.0	27	21.0	5	14	23		
XXXI.	Stirling (Deanston)	5.48	+ 1.28	.81	22	19	50.8	27||	18.0	14	14	20		
XXXII.	Logierait	5.56	...	.71	22	20	50.0	29	19.0	14	...	...
XXXIII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Aberdeen	3.86	...	.42	20	24	48.6	27	25.3	5	11	20
XXXV.	Inverness (Culloden)	1.44	— .49	.59	19	17	52.0	27	28.9	5, 12	8	24		
XXXVI.	Portree	8.81	— 6.82	1.16	22	22	...	...	...	...	...	...
XXXVII.	Loch Broom	3.35	...	.32	23	25	...	...	...	...	...	...
XXXVIII.	Helmsdale	2.85	...	.46	12	23	...	...	...	...	...	...
XXXIX.	Sandwick	4.41	+ .45	.55	22	20	49.0	27||	28.4	12	3	...		
XL.	Cork	10.57	...	1.56	26	19	...	...	...	...	...	...
XLI.	Waterford	11.08	+ 6.66	1.24	1	25	53.0	22	29.0	30	3	17		
XLII.	Killaloe	6.79	+ 3.30	1.00	8	28	54.0	21	28.0	12	12	20		
XLIII.	Portlinton	5.64	+ 1.44	1.06	9	31	53.0	23	27.0	11	9	...		
XLIV.	Monkstown	6.20	+ 3.58	.89	16	23	...	...	...	...	...	...
XLV.	Galway	5.83	...	.97	24	25	54.0	1¶	28.0	4††	13	...
XLVI.	Bunninadden (Doo Castle) ...	5.03	...	...	...	...	...	...	...	...	...	...
XLVII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	5.75	...	1.10	8	22	54.0	23**	24.0	13	14	22		
XLIX.	Strabane (Leckpatrick) .....	...	...	...	...	...	...	...	...	...	...	...

*And 26. †And 23. ‡And 27. §And 23. ||And 28. ¶And 25, 27. **And 24. ††And 11, 12, ‡‡And 12, 15.

+ 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.

LINTON PARK.—A very wet but mild month, the ther. never falling below 41° the last eleven days. The total rainfall (5·26 being 3·43+the average), following the two preceding wet months has raised our yearly total beyond all previous years I have on record. High winds (mostly at night) on 9th, 11th, and 17th. L on the evening of the 8th; bar. very low at 7.30 p.m. on 11th, without much rain, but it was very unsteady the whole month; winds mostly S. and S.W. Frosts on 4th, 5th, 10th, 12th, and 13th, but not severe, so that geraniums and similar plants are still alive on dry and elevated positions out of doors.

SELBORNE.—8th, very tempestuous evening and night, with R, T, and L; terrific gale, a tree blown down. Frost nearly all day on 12th, but E at night. Fog on 14th, 15th, 19th, 20th, 21st, and 22nd, that on 20th very dense; tempestuous wind on 17th. T at night on 23rd; high wind and L at night on 25th. Prevailing winds during the month S.W., excepting from 3rd to 7th and from 11th to 14th. The wet season continues to interfere with agricultural and horticultural work. Much boisterous wind, and great electrical disturbance.

HITCHEN.—On the 8th the most violent gale since my record commenced in 1849. 16th, '90 fell; the heaviest fall of the year. On 26th sulphur butterflies seen.

BANBURY.—High wind at 10 p.m. on 8th, and following morning, also on the 16th and 30th; fog on 12th, 14th, and 16th.

CULFORD.—Up to the 25th the weather was a continuance of the same wet dreary weather which has distinguished the two preceding months; the 25th day, however, was fine for the season, and the 26th remarkably so. H on the 4th; high winds on the 5th and 8th, also on 16th, when it was accompanied with sleet as well as R. Heavy fog on 15th, 17th, 18th, and 19th. Mean temperature of the month 40°·3. Equatorial winds on 19 days, Polar winds on 12 days.

BRIDPORT.—A very wet month; S. and S.W. gales on 20th, 24th, 30th, and 31st. On the 8th a gale of terrific force sprung up about 4 p.m., and lasting till 11 p.m., blowing with the force of a hurricane, doing much damage to trees, roofs, &c.

BODMIN.—A most terrific gale blew on the afternoon and evening of the 8th, but it happily was a brief one. Mean. temp. 45°, being no less than 3° + the average. The rainfall during this year has been 71·93 in., exceeding by 12·29 in. the heaviest fall during the last 23 years; it has been 25·01 in. in excess of the average fall of that period.

HAUGHTON HALL.—Another rainy month, varied by fog, frost, and wind; it opened with better symptoms, frost appearing to be setting in gradually, the nights at or below freezing point up to the 16th, and on that of the 5th, the temp. fell to 23°, when the geraniums were at length cut down; latter part of the month milder than the first; from 21st to end never below 45°. From 16th, inclusive, to end, R fell daily, except on 22nd, 23rd, and 26th. On 16th, from 2.30 p.m. to 9 a.m. on 17th, '94 in. fell, with S for an hour at 2 p.m. Fog on 2nd, 10th, 14th, 15th, 16th, 21st and 22nd. Nothing remarkable followed the sudden fall of bar. to 28·33 on November 30th, it was calm and fine. Violent storm from S.W. on nights of 8th and 24th. Unusually mild Christmas Day, not a holly berry to be seen.

ORLETON.—Great hurricane at night on the 8th; Clee Hills covered with S on 9th; violent wind on evening of 24th; rainy till noon on 25th, then fine till 7 p.m., then showery. In the whole month only five days without measureable rain; the river nearly full all the month, and greatly flooded on the 17th. The clay soil too wet to bear the horses, and no more wheat has been planted. Temp. below the average till the 21st, then much above it till the end of the month. Mean of month about 14½° in excess. Frequent gales, very strong on 8th and 9th, and 23rd and 24th. Bar. at 9 p.m. on 8th, 28·40.

WIGSTON.—Very damp relaxing atmosphere, and the ground so saturated with wet that every considerable fall of rain produced a flood. Agricultural work quite at a stand still.

BOSTON.—Temp. 4·6 above the average of the last seven years at Boston; general condition, mild, wet, and stormy. The gale on the 8th and 9th lasted longer than any known before. The total rainfall of the year is 32·69, is the greatest recorded since 1826, the earliest period from which the observations extend. The small streams in the higher districts are running fuller than they have ever been known to do before, and all the land is saturated with water. A great deal of the low sea lands (except where drained by steam power), was inundated for some days in the middle of the month.

GRIMSBY.—TS at 5·30 p.m. on the 1st; wheatstack fired by the L. at Cleethorpes T. at night on 3rd; gale in evening of 4th. 8th, a pleasant day, but the wind backed from W. to S.S.E. and blew a heavy gale at night, and till 11 a.m. on the 9th. Fine lunar corona, with prismatic colours, on 11th. Large lunar halo on 13th. Heavy R, with gale at night, on 16th. Gale on 24th at night, and high wind on 25th. The rainfall this year is a fourth above the average of the last six years; not one week in the whole year without R. The month very mild, with several gales, especially at night, such weather as we usually have at this period in the absence of frost. Thrushes sang on many days towards the end of the month. Much wheat land not sown, and much of the wheat sown has not germinated.

DERBY.—A mild and genial month, temp. varying but a few degrees throughout. Ther. only on seven nights fell below freezing point. Bar. pressure has been much below the mean. Rainfall two inches in excess.

MANCHESTER.—H, R and storm on 8th, and again with T and L on 9th. S on 5th and 12th.

NORTH SHIELDS.—Heavy R. and wind on night of 8th. Lunar halos on the 9th, 13th, and 14th.

SEATHWAITE.—Heavy fall of S on 16th.

HAVERFORDWEST.—The month commenced fine and rather cold, the weather changed on the 5th; after a sharp night's frost between 9 a.m. 7 p.m., '95 in. of R fell. Terrible storm on the 8th, of R, H and wind, after which several frosty nights occurred; from that period to the end it was a constant succession of R, with storms more or less violent. General health of the community very good, a total absence of zymotic diseases and typhoid, the constant succession of gales and floods appearing to blow and wash away every impurity. From the observations of 23 years I find the present year exceeds the wettest of them by 12·88 in., the total fall for the year being 69·78.

CEFNFAES.—The month damp; much R, with T and L frequent at night, wind generally N.W. Sheep beginning to suffer from the great moisture everywhere.

SCOTLAND.

DUMFRIES.—The closing month has been variable, frequent storms and heavy rain. The violence of the gales have not been felt so much in this district as in other parts of the country. The R has been above the average of five years. Mean temp. 39°·2. Very stormy and much S on the 8th.

HAWICK.—Gloomy December has shown itself true to its poetic reputation this year, and an Italian would have seen as much mud in a minute here as he could see in a month under his own blue skies. A very curious lunar rainbow was seen near the north-eastern horizon about 5 p.m. on the 12th, the lines of the crescent were very distinctly defined, and the rays of color were rich and brilliant, the pretty effect of the division of light was visible for some time.

AUCHENDRANE.—Gales on 17th, 24th, 26th, and 27th; river in high flood on 26th and 27th. Hoar frost on seven mornings and evenings.

CASTLE TOWARD.—The month, on the whole, has been a dull, cloudy, and showery one, scarce any sunshine; prevailing wind fore part of the month E. and N.E., latter part S. to S.W. Rhododendrons in full flower on the 13th.

DEANSTON.—Month wet and for the most part gloomy, with very little sunshine, some smart frosts, which were but of short continuance. Very little

progress made in operations connected with the tillage of the soil. Strong gales and almost continued floods in the rivers. Very little S. in the low country, but considerable falls on the high hills.

LOGIERAIT.—This month has kept up the character of the year; there were a few frosty nights at the commencement, but there were several returns to rain. The rainfall of the year is 15·66 in. in excess of the average for the preceding five years.

ABERDEEN.—A month of very damp dull weather, with low and unsteady bar. and frequent gales.

CULLODEN.—Hive bees out in the garden on Christmas day.

PORTREE.—Very changeable weather during the month, frost, S, and R, alternately. Fine lunar halos on 9th and 14th. S. 6 inches deep on 11th and 12th. Cattle and sheep quite healthy and thriving well on pasture.

LOCHBROOM.—This has been a much better month than the last three or four.

SANDWICK.—Aurora on six nights, one on the 4th followed by a gale of 45 miles an hour, from 3 till 10 p.m., and of 50 miles an hour from 5 to 6. December has had a greater rainfall than the mean, and there being little sunshine or evaporation the ground is very wet, but no floods, as in many other places, and little rain has fallen since the 24th. Frost from 10th to 13th.

I R E L A N D.

WATERFORD.—Storm from S.W. on 8th, and from S.E. on 20th.

MONKSTOWN.—Thrushes singing almost every day at the close of the month, the weather being very mild.

DOO CASTLE.—Very wet month, and few frosty days.

WARINGTOWN.—Incessant storm and rain. The soil thoroughly saturated and no agricultural work possible.

ATMOSPHERIC WAVES.

To the Editor of the Meteorological Magazine.

SIR,—On the authority of the United States Signal Office, the press is now noticing a great wave of storm, which has passed over a width of some 1500 miles on that continent. It is supposed that these storms have passed on to the Atlantic, and that they have possibly caused the late disturbances in these islands. I believe that the storms of America and the hurricanes of the Gulf of Mexico are often felt here, at intervals of about fourteen or ten days respectively. In a similar manner, the northerly storms, which reach Strasburg, visit us within a few days, while parts travel down the Danube through the Black Sea, and part travel into the Rhone valley, both forming easterly gales, in the Mediterranean within a week. Since Strasburg was taken off the Meteorological list, I have left off studying the subject; but as I have frequently stated, it seems, that nearly a precise knowledge of coming storms could be gained by increasing our Meteorological electric stations. The increasing demands of increasing populations will do this in time, but the question now is, would it pay to make them, merely for the doubtful good of calculating the arrival of storms a week or a fortnight before hand?

H. P. MALET.

December.

P.S.—I consider that the frost in England on New Year's Day, and the stormy weather which prevailed at the end of last and beginning of this year, were connected with the storms and cold of America, alluded to in the *Times* of January 9th.

H. P. M.