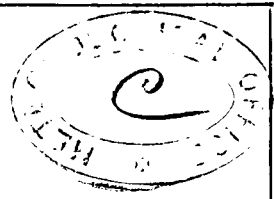


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SYMONS'S

MONTHLY

METEOROLOGICAL  
MAGAZINE.

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VOLUME THE EIGHTH.

~~~~~  
1873.  
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LONDON:  
EDWARD STANFORD, CHARING CROSS, S.W.  
AND ALL BOOKSELLERS.

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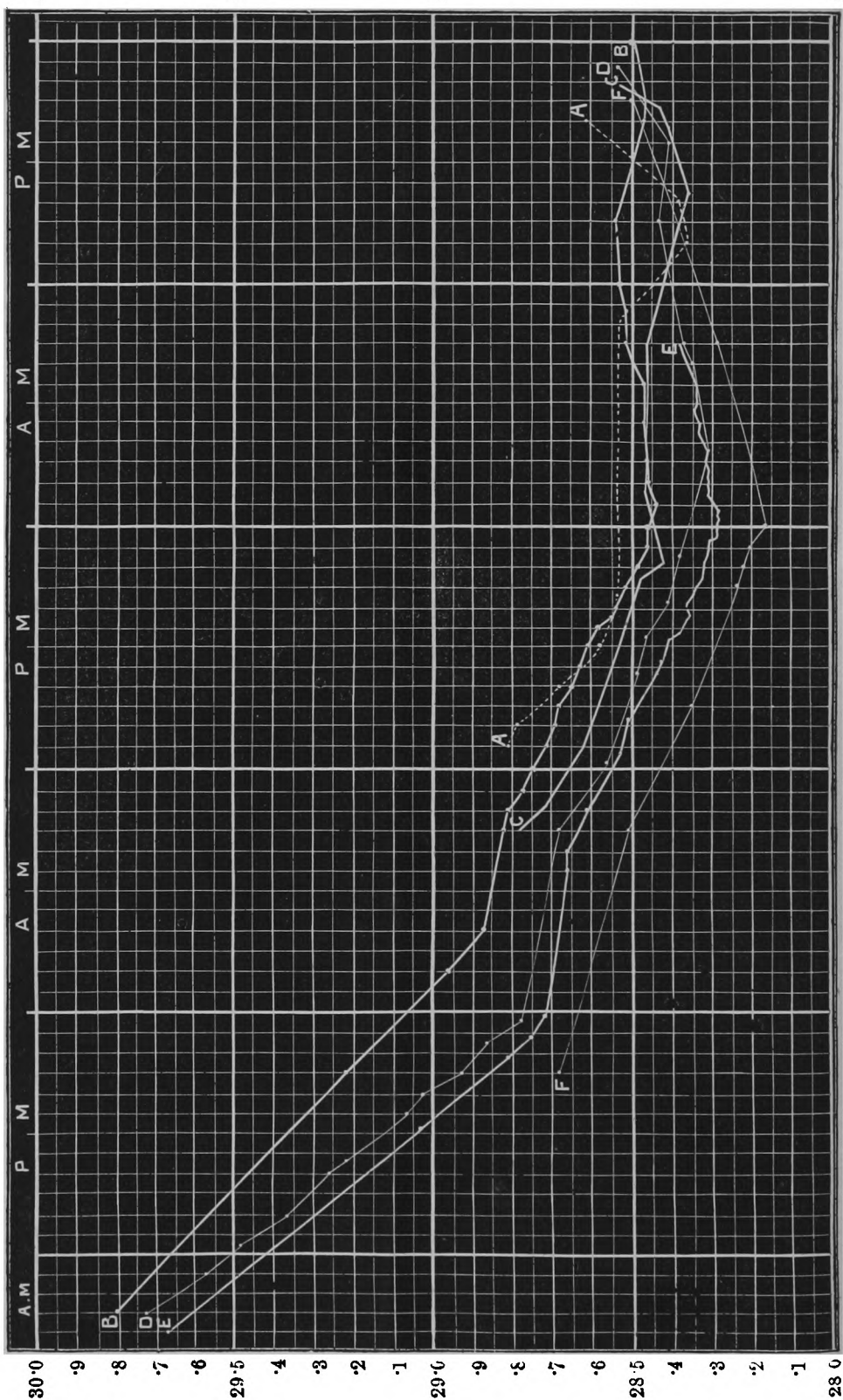
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# SEA LEVEL PRESSURE IN ENGLAND AND WALES, JANUARY 18TH-20TH, 1873.

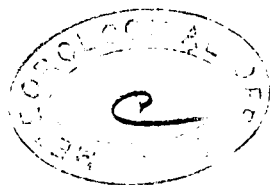
18th. 19th. 20th.



A = Haverfordwest. B = Camden Square. C = Horsford. D = Chesterfield. E = Hinderton. F = Cockernouth.

SYMONS'S

MONTHLY



# METEOROLOGICAL MAGAZINE.

LXXXV.]

FEBRUARY, 1873.

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## INTRODUCTORY.

It has been the practice of the Editor of this Magazine, to preface each volume with a few words as to its aims and scope, but as times change, customs must change also, and thus it seems to us that such explanatory notices are no longer needed. Our little periodical has navigated the troublous seas of public opinion for seven years, not only without shipwreck, but if we may so express it, without the loss of a spar or a rope—or, to drop the metaphor, without missing the regular date of publication, and we believe almost without the loss (except, alas ! by death), of a single original subscriber. While, on the other hand, our correspondents, the size of the Magazine, and its circulation have largely increased. As to size we should in this, the last of our annual Introductions, like to say a word or two. We admit that it is not bulky, but (always excepting publications the printing of which is paid for out of the taxes, *i.e.*, Government papers, of which the price is utterly irrespective of cost of production), we are doubtful if there is any other meteorological publication, whether supported by the funds of societies or otherwise, which gives so much information as is afforded in our pages. We transgress no rule of propriety in stating this fact, because it is to our correspondents rather than to ourselves that it is due.

## THE BAROMETRIC DEPRESSIONS OF JANUARY 19th & 20th.

We have been favoured with correspondence upon this subject sufficient in bulk to fill three numbers of this periodical. This fact alone is of more importance than appears at first sight, it proves—(I.) the wide-spread interest now taken in matters meteorological; (II.), the willingness of observers to take any reasonable or even unreasonable trouble when they think that they can thereby be doing good service,

and therefore, (III.) the large store of volunteer labour still to be utilized. (IV.) Some of the records of eye observations are so complete as to equal, if they do not surpass, those of self-recording instruments. But the correspondence shows also some unsatisfactory features to which it is equally our duty to call attention. Among these, one is, that in spite of the very moderate price at which trustworthy "Kew pattern" barometers can be bought, many to whom the cost can be no object have failed to provide themselves with a standard, and have thereby depreciated, not to say annihilated, the value of their observations. Another feature which we should like to see altered, is the fact that many sets of observations are sent to us wholly uncorrected and unreduced; that which is a small matter for each individually becomes collectively serious, and although we would do anything in our power to help our excellent correspondents, we venture to suggest that all should procure standard instruments, and send in their observations thoroughly reduced.

With these few prefatory remarks, which we are sure will be received in the spirit in which they are penned, we proceed to lay before our readers some brief extracts from this mass of correspondence.

The diagram which forms the frontispiece to this number, shows the general characteristics of the depression at several stations. The most remarkable feature is the length of time during which the pressure remained at a low point; it has been as low, has been *lower* on rare occasions, but at present we are not aware of any case in which the sea-level pressure remained in the south of England at and below  $28\frac{1}{2}$  inches for more than twenty-four hours.

Several writers have called attention to the fact that this great depression was not accompanied by a heavy gale; but what was to cause a gale? it is not the absolute, but the relative height of the barometer which indicates a gale. The depression of 19th and early hours of 20th was a movement on a grand scale, and the pressure over England varied but little; for instance, at 6 p.m. on the 19th it was, in London  $28\cdot61$ , at Ryde  $28\cdot63$ , and at Hereford  $28\cdot61$ ; at 11 p.m., when the lowest point was just touching the Welsh and Cumbrian coasts, we have a somewhat greater difference, but still nothing adequate to produce a gale. The sea-level values at 11 p.m. were:—

Cockermouth	...	$28\cdot202$ .	Ross	...	$28\cdot486$ .
Hinderton, Cheshire	...	$28\cdot308$ .	Fairford, Gloucester	...	$28\cdot490$ .
Sheffield	...	$28\cdot410$ .	Berkhamstead	...	$28\cdot500$ .
Bristol	...	$28\cdot462$ .	Crowboro' Beacon	...	$28\cdot541$ .
London	...	$28\cdot464$ .	Brighton	...	$28\cdot549$ .

The above statement also shows the general shape of the depression—viz., a portion of a somewhat circular figure, with its lowest point between Ireland and Scotland, whence during subsequent hours it passed N.E. ward over Scotland.

It will be seen that the following table has been divided into two portions, respectively headed "First Depression," and "Second Depression"; the meaning of this will be at once evident on referring to

the frontispiece, which shows that while there was at almost all stations a minimum about midnight between 19th and 20th, there was also especially at the western stations another superposed, if we may so express it, which passed over Haverfordwest about 2 or 3 p.m. on 20th, and thence travelled eastwards, reaching Herefordshire about 5 p.m., Bristol about 6, London about 8, and finally Suffolk at 10.15 p.m., by which time it had almost died out.

What then did this depression imply,—We know not,—but this we do know, that after that mighty atmospheric movement had passed away to the N.E., the remarkably mild weather of January, 1873, passed away too, not amid the roar of wind and the uprooting of trees, but amid lightning and thunder, hail and snow, the latter of which has prevailed more or less ever since.

Station.	County.	1st Depression.			2nd Depression.		
		Pressure.	Hour.	Day.	Pressure.	Hour.	Date.
		in			in.		
Haverfordwest..	Pembroke .....	...	...	...	28·365	2.0 p.m.	20
Cockermouth ...	Cumberland ...	28·165	0 a.m.	20	...	...	...
Wrexham .....	Denbigh.....	28·372	11.30 p.m.	19	...	...	...
Hinderton .....	Cheshire.....	28·286*	0.10 a.m.	20	...	...	...
Warrington ...	Lancashire (1)	28·275*	0.15 a.m.	20	...	...	...
Hereford .....	Hereford .....	28·443	10.0 p.m.	19	...	...	...
Ross.....	„ .....	28·486	11.0 p.m.	19	28·407	6.0 p.m.	20
Bristol.....	Gloucester .....	28·436*	11.55 p.m.	19	28·366	5.50 p.m.	20
Bath .....	Somerset .....	...	...	...	28·347	4.0 p.m.	20
Fairford .....	Gloucester.. (3)	28·490	11.0 p.m.	19	28·411	7.0 p.m.	20
Gainford .....	Durham .....	...	1.40 a.m.	20	...	...	...
Sheffield .....	York .....	28·410	11.0 p.m.	19	...	...	...
Chesterfield ...	Derby.....	28·317	3.0 a.m.	20	28·420	7.0 p.m.	20
Ryde .....	Hants .....	...	...	...	28·548	See Note.	...
Berkhampstead	Herts .....	...	...	...	28·470	8.45 p.m.	20
Camden Square	Middlesex .....	28·447*	1.0 a.m.	20	28·474*	8.0 p.m.	20
Brighton .....	Sussex .....	28·528*	1.15 a.m.	20	...	...	...
Beckenham.....	Kent .....	28·486	11.30 p.m.	19	...	...	...
Crowboro' .....	Sussex .....	28·541	11.0 p.m.	19	28·557	8.0 p.m.	20
Cambridge .....	Cambridge (5)	28·44	2.15 a.m.	20	28·49	8.0 p.m.	20
Beccles .....	Suffolk .....	28·33 *	2.0 a.m.	20	28·44 *	10.15 p.m.	20

Readings to which \* is affixed are known to be absolute minima.

- (1) Pressure increasing all the evening of 20th.
- (2) Probably 28·367 at 5 p.m.
- (3) The bar. fell 0.016 between 6 and 7 p.m.
- (4) Pressure stationary from 10.30 a.m. to 10 p.m. on 20th, at 28·548.
- (5) Pressure stationary between 11.15 p.m. 19th, and 6.15 a.m. 20th.

#### REMARKS.

**HAVERFORDWEST.**—On Sunday, the 19th, the morning was cold, clear, and chilly; the bar. at 9 a.m. stood at 28·70, with a decided downward tendency; a deceptive calmness prevailed, and about 1 p.m. a sudden storm of hail, thunder, and lightning, with heavy squalls, occurred; about 2 p.m. the sky became black as night, and another and heavier storm took place, the bar. still falling; the night was very stormy, and the squalls at times were very violent. On the morning of the 20th, the Precelly Hills were covered with snow, the sky very wintry and bar. still falling; about noon a blinding snow storm (with very little wind)

occurred; about 2 p.m. it ceased, the sky darkened, and a grand storm of the loudest thunder, accompanied by vivid lightning, and enormous hail, took place; the rest of the day precarious.—*E. P. Phillips.*

COCKERMOUTH.—No gale or high wind, although the barometer has not been so low for eleven years.—*H. Dodgson, M.D.*

TREVALYN HALL, WREXHAM.—Jan. 19th, flashes of lightning were seen, and one peal of thunder was heard soon after 8 p.m., when the bar. was approaching its lowest point; some snow fell in the morning; wind light to moderate.—*B. T. Griffith.*

DARTMOOR PRISON.—Forked lightning and thunder at 6 p.m. on 19th, and lightning without thunder at 9 p.m. on 20th.—*R. E. Power, M.D.*

HINDERTON, NESTON.—No very unusual condition of the weather accompanied this remarkable depression. On Saturday night (Jan. 18th) there was a stiff breeze from S.W., with driving rain (·40 in.). The morning of the 19th was very bright and fine; wind W.S.W., gentle breeze. The wind freshened very much about noon, and veered to W. and W.N.W.; at 2.30 it backed to W.S.W., and blew pretty hard, but it never amounted to a gale. Dense masses of cloud (cumulus) were heaped up, but there was no downfall until 8 p.m., when some hail fell. This occurred several times during the night, to a sufficient extent to make the ground white. During the night the wind was unsteady, about W.S.W., and swept on in fitful gusts. Temperature fell rapidly about midnight, and this morning (Jan. 20) the grass thermometer fell to 26°·9. Occasionally I experienced some difficulty in obtaining correct barometrical readings owing to the marked oscillation of the mercury. I took all the observations myself.—*Reginald Bushell.*

HEREFORD.—Snow both on 19th and 20th, lightning on 19th at 8 p.m., and lightning, with loud thunder and snow on 20th at 7.30 p.m.; very little wind, mostly S.W. Absolute min. believed to have occurred at 5 p.m.—*E. J. Isbell.*

THE CRAIG, ROSS.—One or two flashes of lightning at 8 p.m., 19th; and thick snow storms on 20th.—*H. Southall.*

FRENCHAY, BRISTOL.—On Jan. 19th, from 5.30 to 6.30 p.m., light breeze, occasional moderate gusts; to 7.15 nearly calm; 7.30 dead calm, light breeze to 8; wind high and rainy until 8.30, afterwards a lull to 9.15; at 9.45, heavy rain and high gusts; a lull to 10.15, when there was heavy rain and wind, with a loud clap of thunder; afterwards wind fresh, but variable. At 11.45 wind again high and gusty; 11.55 lowest reading of barometer; a lull till 0.30 a.m. on 20th, after which hail and sleet, with occasional squalls. 8.30 a.m., fine, calm, hail and snow on ground. From 4.50 to 5.15 p.m. four or five very vivid flashes of lightning, with loud thunder. 6 p.m., hail, and wind gusty, at times blowing hard till 7 p.m.—*F. F. Trickett.*

HATHEROP RECTORY, FAIRFORD.—During most of the night of the 18th, there were gusts of wind, but afterwards the atmosphere was comparatively calm, and that not only while the great depression lasted but also during the subsequent rise. About 10 a.m. on 19th, there was a vivid flash of lightning, followed instantly by a loud crash of thunder. The mercury was stationary almost the whole of the day on the 20th, but began to fall still lower in the afternoon, reaching the lowest point 27·971 in. about 7 p.m.—*R. P. Davies.*

MYRTLE HOUSE, SHEFFIELD.—Hail storms at intervals during the 18th; vivid lightning from 7 p.m. until 11 p.m. Sharp frost in night, light west wind.—*S. Richards.*

BRAMPTON ST. THOMAS, CHESTERFIELD.—No special atmospheric disturbance, merely a few hours' high wind on 18th; the 19th and 20th calm, with light air from S.W.—*J. M. Mello.*

RYDE.—Jan. 19th, stormy, overcast and rain, vivid lightning in evening. 20th, fresh, cloudy, hail and rain in the afternoon; vivid lightning and strong winds in the evening. 21st, fresh, and overcast; rain in the night.—*R. Taylor.*

CROWBOROUGH BEACON OBSERVATORY.—On the 19th the sky was overcast with very heavy clouds in all directions; the small patches of visible sky looked particularly green, and distant terrestrial objects very near; the day proved, for the most part, overcast, and the evening rainy. Soon after midnight we had a sharp thunderstorm, which was followed, before daylight, by a reduction of

temperature to  $27^{\circ}6$ ; hard ground frost. The 20th was much colder; heavy masses of cloud were visible over the channel and west coast of France; hail showers just before sunset; vivid lightning and loud crashes of thunder from 7 to 9 p.m., and hail showers; vivid lightning in the east, lighting up the landscape for miles.—*C. L. Prince.*

GELDESTON, BECCLES.—We had a gale on 18th and 19th, but generally calm weather; lightning in evening of 19th and 20th; snow on 21st.—*E. T. Dowson.*

Additional data respecting this depression and the accompanying weather, will be found in the notes of our regular correspondents.

## RECENT ANTI-CYCLONES IN WESTERN EUROPE.

*To the Editor of the Meteorological Magazine.*

SIR,—The last three quarters of the past year were characterized by the relative frequency of anti-cyclonic systems in the extreme north and east of Europe, and by their remarkable paucity and want of permanence upon the Atlantic and Mediterranean coasts.

I send a few notes of those anti-cyclones which have been of importance or have exhibited any stability from the end of September to the end of January in Western Europe; (premising that I define an "anti-cyclone" simply as a circular, or approximately circular area, bounded by isobars, and having higher pressures, and a "cyclone" as a similar area having lower pressures than those of surrounding districts.)

During October no anti-cyclones of any stability existed west of longitude  $20^{\circ}$  E. A feeble system, which hung over North Italy, at the commencement of the month, a second which appeared in the north of Ireland on the 5th, and a third, which was developed in Sweden about the 18th, gave way almost immediately before depressions advancing from the Atlantic.

November, though inequalities of pressure were very much higher than in the preceding month, was characterized by a somewhat greater firmness and persistency in the systems of currents. During the first week, depressions passing rapidly across north-western Europe, an anti-cyclone hung over Spain, shifting to N.E. on the 8th, and then disappearing. On the 11th an anti-cyclone began to develop itself in Northern Scandinavia. Its central pressures soon rose to  $30\cdot7$  in., and the system, coinciding with areas of depression in Southern and Central Europe, was remarkable for the extreme steepness or intensity of its southern portion. It gave way a great deal before a cyclone in Great Britain on the 16th, but then recovered somewhat, shifting slowly north-eastwards, and finally disappearing under the influence of Atlantic depressions about the 21st. A slight anti-cyclone now showed itself for some days over the Alps, but retired southwards, and subsequently hung over the Mediterranean.

During the first half of December the cyclonic currents were again prevalent throughout Western Europe; depressions followed one another with rapidity, the Portugal coast receiving the smallest share. On the 15th, however, an anti-cyclone appeared on the Baltic, with

frost ; and though oscillations were felt as depressions passed on its south during the third week, the system was steadily maintained until the 23rd, when it broke down under the influence of great Atlantic cyclones. An anti-cyclone again immediately showed itself over Austria and the North of Italy, which though subject to considerable oscillations, proved of rather persistent type.

This system migrated slowly westwards, and in the first week of January its centre was established over the Maritime Alps ; in this district it continued, with only slight and temporary shifts of position, during the second and part of the third weeks. The system closely resembled others which commonly hang over Northern Italy, Switzerland, or the south of France during periods when the north-west of Europe is visited by great Atlantic depressions. On the 18th it gave way under the approach of the very extensive cyclone in the north-west. In the third week an anti-cyclone established itself on the Baltic, with increasing frost. This system proved stationary and persistent. It was most extensive on the 27th, when isobars had anti-cyclonic curves over all Western Europe, reached its climax on the 31st, and partially gave way before the cyclonic system which passed up the English Channel on the 2nd of February.—Yours truly,

W. CLEMENT LEY.

---

### ATMOSPHERIC WAVES.

*To the Editor of the Meteorological Magazine.*

SIR,—For upwards of a quarter of a century the subject of atmospheric waves has received but little attention from Meteorologists. Requiring no little amount of labour in analysing the barometric curves at several stations far apart, and also for analysing the isobars or lines of equal pressure over a large portion of the earth's surface, it has obtained but a passing notice now and again as a succession of high readings of the barometer has been registered, or some disastrous gale has swept over our seas, accompanied by a more than ordinary depression of the barometer, the result of a reduction of pressure but seldom experienced.

The weather maps of our own Government, of the continent of Europe, issued at the observatory of Montsouris, and of America, issued three times daily at Washington, are registers, more or less available, of the elements of "atmospheric waves." How far a correct conception of an atmospheric wave really exists in the collective meteorological mind it is difficult to define. A succession of high barometers over a large tract of country is quoted as "a wave of high pressure," and an extraordinary depression of the barometer is, in like manner, quoted as "a wave of low pressure," but so far as I am aware no attempts have been made within the period above-named to characterize such waves by giving the numerical values of their amplitudes and altitudes, their rates of progress, &c.,—elements that must be of the last importance in the formation of any reliable probabilities of coming weather.



One of the earliest results of the enquiry was the establishment of a series of barometric movements in the month of November, the barometric curves of which in some localities assumed a very decided symmetrical character. There is reason to believe that some time about the middle of November these movements *return* annually in more or less the same order. In November, 1872, the crest, or highest of these movements, passed London about the 9th. On the 15th of November, 1872, 7.35 a.m., Washington time, the chief signal officer, Brigadier-General Albert J. Myer, announced that "the great atmospheric wave of high barometric range moving across the continent from west to east, and averaging nearly thirty and a half inches of pressure, now extends from Oregon to the mid Mississippi valley and the Gulf coasts, propagated in continuous bands of north-westerly winds," and the map of November 15, 4.35 p.m., shows a high pressure of 30.60 in. in the extreme north-west, and a low pressure of 29.60 in. in the north-east, thus from Fort Benton, latitude about  $47^{\circ}$  N., longitude about  $110^{\circ}$  W. to Quebec, latitude  $47^{\circ}$  N., longitude  $71^{\circ}$  W., a difference of one inch of mercury existed. At New Orleans, latitude  $30^{\circ}$  N., longitude  $90^{\circ}$  W., the pressure was 30.33 in. In accordance with these pressures the isobaric bands had a N.W.—S.E. direction; one direction at right angles to this being that of the anterior slope of the wave with its characteristic north-west wind blowing parallel to the isobars.

If it be a fact that these movements return with the seasons, the sun—to use a graphical expression of the late Sir John Herschel—producing in his annual course the same kind of wash-wave at each season in the shallow basin of our atmosphere, every addition to our knowledge of them must be valuable. During the last five years a remarkable depression of the barometer has been recorded in the publications of the Meteorological Committee. In 1869, it was registered, at the self-recording stations, between 6 p.m., of January 14, and 7 a.m. of the 15th, lowest reading 28.85 in. In 1870, between 7.0 a.m., and 7.30 p.m. of the 14th, lowest reading 28.75 in. In 1871, between 10 p.m. of January 15, and 2 p.m. of January 16, lowest reading 28.176. In 1872, between 6.30 p.m. of the 17th, and 8.0 a.m. of the 18th, lowest reading 28.06; and in 1873, on the 20th, 8 a.m., the reading at Thurso was 28.11. At present it is impracticable to give a closer approximation to the elements of this trough or wave of depression, nevertheless the evidence appears to be sufficiently conclusive to establish the existence of three seasonal barometric waves—the European November wave, the American November wave, and the European trough of January.

Yours very truly, W. R. BIRT.

#### DAILY VARIATIONS IN THE PREVALENCE OF RAIN, JANUARY, 1873.

THE new year opened with an improvement in the weather, as the disturbance, which marked the closing day of September, was passing

off; but the change was very temporary. Before noon the mercury was again descending rapidly at Valencia, and a series of depressions continued to pass over us in a northerly to a north-easterly direction, their centres being generally outside the Atlantic Borders of the British Islands. This continued uninterruptedly until the 5th, and in some instances, slight local oscillations occurred, in addition to those of the more general storms. Distinct baric minima occurred on the night of 1st, morning of the 3rd, and on the 4th, their advent being marked by strong southerly winds or gales and very general rains, with some hail and much lightning and thunder at the western stations. The recovery of pressure on the 4th was, however, rather more marked in the west than that on the preceding days, and at 8 a.m., 5th, the isobars lay more west and east than of late. The early hours of the 6th brought a fresh but slight disturbance to the north-western districts, which was felt, in a less degree, even in the south and south-east, and the rainfall was temporarily renewed in all parts of the Kingdom. This passed off, and, except over the outlying western and northern counties, the weather became finer. On the 7th broken weather returned; for with the advancing day we find the western and northern barometers again falling, and at night south-westerly gales and rain occurred in the north-west and north. Scarcely had this *bourrasque* passed than the barometer again fell in the south-west, and this time (on the 9th) the storm passed more completely over us, so that all parts of the country felt the rain. Through the 10th pressure rose generally, though southerly winds and some rain continued; and on the 11th the weather was more favourable in the north and east. The 12th and 13th, however, were marked by an extensive depression, whose centre travelled from west to east some distance to the northward of our Islands, but whose influence spread to our most southerly coasts, bringing a renewal of south-westerly winds and rain. As this passed away, thunderstorms occurred in the north of Scotland (on the 13th), and while the weather cleared for a time in the north of England, the morning of the 14th found a new diminution in Ireland, with rain at the western stations. Pressure now became more uniform in France and the south of England, accompanied by clearer weather; but on the 16th these improved conditions were broken into by a shallow disturbance, which advanced over St. George's Channel, and was itself succeeded by several very irregular changes of pressure and wind in the north and west, accompanied by heavy rains. On January 18th the south-eastern portion of an unusually extensive and deep depression showed itself at our north-western stations, and advancing in a south-easterly direction, extended gradually over the whole of western Europe. At 8 a.m. on the 20th the barometer (at 32° F., and mean sea level) was as low as 28·11 in. in the north of Scotland, and throughout our Islands, Norway, Denmark, Holland, and the north of France readings were below 29 in. Considerable rain accompanied the barometric fall, and on the 19th, snow, hail, thunder and lightning occurred in addition. A partial recovery of pressure during the 20th

was accompanied by a great reduction of temperature, so that in the night the thermometer in the shade at York fell to  $16^{\circ}$ , and on the whole the weather improved slightly. The next day brought a renewal of the fall in the west, and in addition to the generally low condition of pressure a small *bourrasque* crossed Ireland and England, and lay over Holland at 8 a.m. 23rd. Its passage was marked by general precipitation, but was followed by a temporary improvement. At 8 a.m. 24th, a new and deep depression had advanced to the north-west of France. Copious rainfall had occurred at the south western stations, and a less quantity in all but the north-eastern districts. During the day, however, the disturbance became suddenly filled up, the rain ceased, and the 25th found a region of high barometer lying precisely where the low barometer had been 24 hours earlier, extending northwards to central England, and southwards over the Bay of Biscay. A marked improvement in the weather now took place, first in England and then in Scotland. The barometer rose over all the eastern regions during the remainder of the month, the area of high pressure so formed extending slowly westwards. Thus, though southerly winds prevailed, they were light, as a rule, and in England the weather was fine. In Ireland, however, some barometrical oscillations were recorded, which point to the disturbed weather still prevailing over the Atlantic; and as the various depressions swept over that country, rain fell there rather copiously, and occasionally extended to Scotland also.

Thus we see that all the early part of the month was wet *generally*, but while in the latter part, the region of precipitation lay to the westward of England, Ireland was almost constantly within its limits; and so it comes to pass that a great excess of rain in the latter country occurred simultaneously with a deficit in the former.

In future notices it is proposed to dispense with so minute a *résumé* as the above; but after glancing briefly at the general conditions which prevailed, to substitute some account of the proportion of the monthly fall which may be ascribed to the various *meteorological periods* into which the month seems to have been divided. These values will be, necessarily, somewhat rough at times; but such an analysis seems to offer the best method at present available for making further progress in the discovery of the laws which govern the distribution of rain over our Islands.

F. G.

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### A CONFERENCE.

*To the Editor of the Meteorological Magazine.*

SIR,—From the letters which appear in your Magazine, and in other scientific journals, I gather that there is a very wide-spread dissatisfaction with things Meteorological, and the question is, how are matters to be put right? Observers have not yet decided what a shade is, or whether four feet above the ground, or any other number of feet, is the best point at which to obtain the mean temperature of the air. There are other knotty questions to be set at rest before observers can feel full

confidence in their work, and, therefore, I suggest that there should be a *Conference of British Observers*, whose views might be thereby efficiently represented, at the Vienna General Congress of Meteorologists.

Yours very truly,

SAMUEL H. MILLER.

[We cheerfully give to the above proposal our cordial support, so far as relates to a British Conference, but we are not sure that its decisions could be "efficiently represented at the Vienna General Congress of Meteorologists." Subject to correction by those who possess fuller information, we understand the present state of affairs to be as follows: The Leipzig Conference was summoned by the State Meteorologists of Austria, Russia, and the Netherlands, *not* in their official but in their private capacities, and the invitations were widely spread, including all those who possessed the requisite meteorological knowledge, including, in short, the representatives of governments, of societies, and amateurs. This conference met on August 14, 15, and 16, and was well attended. A report of its proceedings has already been published in Dr. Jelinek's *Zeitschrift*, and the Meteorological Committee of the Royal Society are preparing an English translation. At the meeting of the Meteorological Society in December last, Mr. Scott gave a brief *résumé* of the proceedings of the conference, and at its conclusion Mr. Symons suggested that after the translation had been published and circulated, it might be desirable for the Society to devote an evening to a discussion of the views enunciated. The proposal was very favourably received, and we believe it is the intention of the Council to adopt it. The only difficulties which we see in the matter (and virtually this proposal and Mr. Miller's are identical), are two: first whether it will be possible to consider such a variety of subjects in one evening, and do justice to them all.—Secondly, We understand that the Vienna meeting is to be a purely State affair, to which none but the representatives of Government departments will be invited. If our information on this point is incorrect, it will not be difficult to find an efficient representative of non-official British meteorologists, but as there is some uncertainty on the subject, and there is an old adage as to the value of proffered services, we should prefer Mr. Miller's proposal to terminate with the word "observers" in the last line but one. We believe that British amateurs are both able to assist and willing to do so in any way that they can, but that they have no desire to obtrude their advice where it is not requested.—ED.]

#### REVIEWS.

*The Ruinfall in Devonshire in 1871, and in the six years ending December 31st, 1871.* By W. PENGELLY, F.R.S. [From Trans. Devon Assoc. for the Advancement of Science.] 8vo., 21 pp., and folding tables.

As this paper is identical in principle with others by the same author which have been noticed in these pages, it is only necessary to state that Mr. Pengelly continues his exhaustive analyses of the Devonshire

Returns, given in Mr. Symons' "British Rainfall," and supplements them with abstracts of the returns for other counties. There are two columns in one of the tables which supply suggestive information not given in "British Rainfall," viz., the number of gauges in each county, and the average number of acres represented by each gauge, in other words  $\frac{\text{Area of County.}}{\text{Number of gauges in it.}}$  "this value" varies from "6,743 acres in

Middlesex to 138,884 in Anglesea, and averages 33,475 for the whole country." That is to say, supposing it were possible that the Middlesex gauges could be all placed in the most suitable positions, each would be in the centre of an area of 6,743 acres, or about 10 square miles; would be in fact between 3 and 4 miles apart,—while in Anglesea each gauge represents 217 square miles, which would make the stations nearly 17 miles apart. The average for all England and Wales is 33,745 acres, or 53 square miles or 8 miles apart. Now for drainage and engineering purposes this distance is too great, and unfortunately the real state of matters is worse than that shown above, because the stations are not, as is above assumed, distributed in the spots where theoretically they *should* be, but where practically they *can* be. Devonshire for instance has one gauge to each 22,216, or 35 square miles, and yet we believe there are seven distinct areas in Devonshire of 100 square miles each, in not one of which is there a single rain gauge. We think the Devonshire Association and the able author of the work under notice, might advantageously take steps to fill up these *lacunæ*.

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*Reduction of the Meteorological Observations made at the Royal Horticultural Gardens, Chiswick, in the years 1826-69.* By JAMES GLAISHER, F.R.S. [Supplement to Vol. II of the Journal of the Royal Horticultural Society of London. New Series.] London: Printed by Spottiswoode and Co., 8vo., 66 pages, and many folding tables.

THE Council of the Royal Horticultural Society acted wisely when they resolved that the observations made at their Chiswick gardens during forty-four consecutive years, should be discussed and printed, and in entrusting them to Mr. Glaisher, they placed them in the hands of one who has done more work of that class than any other three men in the United Kingdom.

It is self evidently impossible in the limits of a review, to discuss a work which must contain close upon 100,000 entries, but we may state that the more important series of tables give the mean temperature, range of temperature, and rainfall on every day from January 1, 1826 to December 31, 1869, also the difference between the mean temperature of each day and of the corresponding day for the whole forty-four years.

We can quite understand that considerations of the expense may have compelled some omissions, such as tables of the absolute maximum and minimum temperature of each day, of the hygrometric results

and of the direction and force of the wind. A list of the erroneous readings detected by Mr. Glaisher, by comparison with the Greenwich records, would have scarcely increased the cost perceptibly, and would have been very useful.

As the maxima and minima are not given, Mr. Glaisher's valuable emendations are to a great extent lost. Another source of regret is the absence of any plan or sketch of the instruments in position, or any note of the errors of those last in use, even the height of the place of observation above sea level, and the description and size of the rain gauge, and its elevation above the ground are omitted.

While we cordially welcome a valuable contribution to our knowledge of the climate of London and its suburbs, and thank the Royal Horticultural Society for their public spirit in bearing the expense, we have not hesitated to point out the data which we should be glad to see in a supplementary volume.

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*Scottish Meteorology, 1856—71, computed at the Royal Observatory, Edinburgh.* [Excerpt from Vol. XIII. of the "Edinburgh Astronomical Observations."] Oblong 4to, 106 pp., 1 plate.

WE do not share Prof. Smyth's estimate of the value of the mean results quoted in the earlier portion of this work ; without altogether declaring it useless to take the mean of meteorological elements of a batch of places selected merely because they happen to be those in which a large number of human beings reside, we certainly hold it of small utility. It is one thing to note the diseases, mortality, and climate of Greenock and of Aberdeen, and to note the special features of each ; *that* might, should, and doubtless would, lead to useful inferences ; but if the diseases, mortality, and meteorology of all the towns are averaged, we believe almost all the instructive features would be obliterated, and we are certain that this is the case with their meteorology as quoted in the first part of the work before us.

The second article is quite different ; it is a monograph of the Hyperborean storm of October 2nd and 3rd, 1860, which is treated in a most able and complete manner. Some of the incidental remarks in the introduction are quite in Prof. Smyth's happiest vein, as, for instance, where he contrasts the liberality of all other national bodies, and even of private individuals, in supplying meteorological information with the demands for payment and recognition made by the Meteorological Committee ; and when he recounts the history of the storm signals instituted by Admiral FitzRoy, and their stoppage by the Meteorological Committee when they took charge, or became as Prof. Smyth puts it, "the new tenants of Admiral FitzRoy's rooms." Another most amusing chapter which is headed, "Of a Bill sent in by the Richly Endowed office in London, to a Poor Voluntary Society in the Provinces," contains many plain truths put in a manner which may be inferred from its title.

JANUARY, 1873.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.				Days on which -01 or more fell.	TEMPERATURE.				No. of Nights below 32°		
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.			Max.		Min.				
				Dpth	Date.		Deg.	Date.	Deg.	Date.			
inches	inches.	in.			Deg.	Date.	Deg.	Date.	In shade	On grass.			
I.	Camden Town .....	2.44	+	.49	.44	4	18	53.9	4	28.4	25	10	11
II.	Maidstone (Linton Park) .....	2.69	+	.63	.55	19	21	56.0	11	28.0	28	11	...
"	Selborne (The Wakes) .....	5.39	+	2.12	1.01	9	20	55.0	11	20.0	20	10	12
III.	Hitchen .....	2.80	+	.66	.65	3	17	51.0	4†	24.0	27	13	...
"	Banbury .....	2.45	+	.36	.58	18	17	55.0	18	24.5	25	12	...
IV.	Bury St. Edmunds (Culford). .....	1.91	+	.04	.46	4	17	54.0	14	24.0	24	12	15
V.	Bridport .....	3.88	+	.69	.45	4	22	54.0	10	25.0	25	9	...
"	Barnstaple .....	5.43	+	1.91	.93	18	23	55.0	9	30.0	25	...	...
"	Bodmin .....	8.52	+	3.33	1.08	25	23	53.0	4, 10	31.0	21	3	8
VI.	Cirencester .....	3.72	+	.72	.77	18	18	...	...	...	...	...	...
"	Shiffnal (Haughton Hall) .....	2.37	+	.47	.41	18	18	52.5	13*	23.0	25	15	...
"	Tenbury (Orleton) .....	3.29	+	.76	.64	4	20	56.3	14	22.5	29	11	13
VII.	Leicester (Wigston) .....	1.61	—	.37	.37	21	14	54.0	10†	22.0	20	14	...
"	Boston .....	1.90	+	.19	.57	18	15	55.0	14	22.0	21	11	...
"	Grimsby (Killingholme) .....	2.11	...	...	.48	4	13	53.0	4†	26.0	21**	7	...
"	Derby .....	2.04	+	.25	.56	4	14	55.0	14	24.0	21	10	...
VIII.	Manchester .....	3.14	+	.62	.50	3	21	...	...	...	...	...	...
IX.	York .....	2.12	+	.54	.39	4	13	51.5	10	17.0	21	11	...
"	Skipton (Arncliffe) .....	8.90	+	3.26	.82	13	22	50.0	14	16.0	24	11	...
X.	North Shields .....	1.02	—	1.09	.18	15	21	54.6	13	26.3	21	8	11
"	Borrowdale (Seathwaite) .....	28.64	+	12.28	3.85	13	21	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	5.35	+	1.61	.83	18	22	...	...	...	...	...	...
"	Haverfordwest .....	7.88	+	2.83	1.03	27	25	52.2	8	32.0	20††	2	11
"	Rhayader (Cefnfaes) .....	5.64	+	1.12	.79	8	19	51.0	...	20.0	...	...	...
"	Llandudno .....	5.81	+	3.27	.51	2	22	54.9	14	28.4	29	4	...
XII.	Dumfries .....	6.44	+	1.84	.70	18	22	53.0	13*	22.5	25	9	5
"	Hawick (Silverbut Hall) .....	5.62	...	...	1.02	18	24	...	...	...	...	...	...
XIV.	Kilmarnock (Annanhill) .....	5.41	...	...	.85	16	23	52.0	7††	13.0	21	9	...
XV.	Castle Toward .....	7.77	+	1.48	1.25	14	24	53.0	6§	...	...	...	...
XVI.	Leven (Nookton) .....	3.69	+	.82	.84	16	21	52.0	6§	21.0	29	11	27
"	Stirling (Deanston) .....	6.67	+	1.95	.92	13	24	51.0	8	15.2	25	13	22
"	Logierait .....	5.44	...	...	.70	26	21	50.0	15	17.0	24	14	...
XVII.	Braemar .....	4.48	+	1.35	.76	18	23	51.1	14	18.0	22	14	23
"	Aberdeen .....	2.70	...	...	.59	16	20	54.2	14	28.3	25	8	23
XVIII.	Inverness (Culloden) .....	1.52	—	.76	.44	13	19	50.0	8	28.8	25	4	26
"	Portree .....	12.73	—	.36	1.62	6	27	...	...	...	...	...	...
"	Loch Broom .....	6.81	...	...	1.14	10	21	...	...	...	...	...	...
XIX.	Helmsdale .....	2.07	...	...	.42	6	19	...	...	...	...	...	...
"	Sandwick .....	3.52	+	.23	.45	4	25	51.1	14	29.3	20	4	15
XX.	Caherciveen Darrynane Abbey .....	7.79	...	...	.94	23	30	...	...	...	...	...	...
"	Cork .....	9.70	...	...	1.58	15	20	...	...	...	...	...	...
"	Waterford .....	8.02	+	3.16	1.60	16	28	52.0	13	26.0	21	6	...
XXI.	Killaloe .....	7.72	+	2.86	1.02	15	26	53.0	12†	16.0	21	10	19
"	Portarlington .....	4.32	+	.31	1.02	16	31	52.0	7	23.0	20	8	...
XXII.	Monkstown .....	3.37	—	.02	1.00	15	21	54.0	13	23.0	24	9	...
"	Galway .....	7.13	...	...	.84	4	26	53.0	8, 12	15.0	21	7	...
XXIII.	Bunninadden (Doo Castle) .....	5.01	...	...	...	...	...	...	...	...	...	...	...
"	Waringstown .....	3.93	...	...	.53	18	22	54.0	14	23.0	20	10	21
"	Edenfell (Omagh) .....	4.69	...	...	.51	25	23	51.0	13	17.0	20	18	...

\*And 14. †And 11, 14. ‡And 13, 14. §And 7, 14. ||And 31. ¶And 29. \*\*And 25. ††And 24.  
‡‡And 8, 15.

+ 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.—First 20 days mild and often wet, then slight frost set in, getting sharper towards the end, but no S. Bar. very low on 19th, 20th, 21st, and 22nd, with T and L on night of 20th. The highest winds on 4th and 19th, but not very high. It is, however, singular that no frost occurred from Dec. 13th to Jan. 21st, a period of 38 days! Winds mostly S.S.W. and W. to 23rd, after which they were mostly E. Very little sun during the month, and still less fog.

SELBORNE.—Tempestuous night on 1st, wind from N.W.; H and L in evening of 2nd. Violent hailstorm at 2 p.m., L in morning, T in evening of 3rd. Prevailing winds after the 1st, S.W. to the 22nd, afterwards variable, but inclined to S.; on 17th it changed for about an hour to N. Bar. fell on 19th in evening to 28·53 (corrected), and so continued all day on the 20th, a lower reading than I ever remember; S in early morning, L at night, and white frost on the following morning; fog on 4 days during the last week. On the whole a tempestuous month.

HITCHEN.—L on 3rd and 19th. 19th the lowest reading of the bar. since I first kept a record in 1849.

BANBURY.—High wind on 1st, 2nd, 4th, 9th, 18th, 19th, and 26th; S, T and R on 20th. Bar. at 8 p.m., 27·974 at 32°; heavy fog on 25th.

CULFORD.—Mild weather until the 20th, when a change took place, the weather becoming colder, and so continuing until the end of the month. S fell slightly on the 20th, and at night T was heard and L seen.

BRIDPORT.—South-westerly gale on the first five days of the month; south-westerly gale on the evening of the 18th. The bar. fell from 9 a.m. on 19th to 9 a.m. on 20th 14 in.; lowest reading 28·50 at 8 p.m. on 20th; sleet on the 29th. slight S here on the 30th, six miles distant it was 1 foot deep; a little L on 3rd and 19th.

BODMIN.—A heavy southerly gale on 18th; R, H, and S on the 19th, and a severe TS, with hail-squalls at 4.55 a.m. on 20th. Bar. 28·48 on 20th; mean temp. 43° or ·5 above the average.

CIRENCESTER.—The bar. (Aneroid) on the 19th lower than seen for several years, 27·8 (uncorrected); although the weather improved, the bar. remained stationary, indicating something unusual; on a previous occasion this continued lowness of the bar. was a forerunner of snow, and such was also the case this year.

HAUGHTON HALL.—The new year began (as the old one finished) with persistent rain, which fell every day with two exceptions (6th and 10th) till the 14th. On the 18th it set in again for five days, mixed with sleet on the 19th and 20th, and accompanied by the lowest bar. for years (28·08). On 23rd a drier change took place, which lasted (except on 26th) till the close. To the 18th the temp. was mild, max. ranging from 45° up to 53°, from which day it never exceeded 41°, and frost took place nightly; on those of 24th and 28th; temp. fell to 23°. TS at 8 a.m. and another at 2 p.m. on the 3rd; prevailing winds N.W. to S. till 26th, when it changed to E. and S.E., till the close. Aconite in flower on 9th, snow-drops white on 10th, hazel catkins fully out on 13th, nettles showing on 14th, snowdrops open on 17th; throstle sings daily till 18th.

ORLETON.—A very stormy and rainy month, rivers very full, and floods on the 5th; land very wet, very little sun; T heard on 2nd, 3rd, and 20th; L seen on 2nd, 3rd, and 19th; great winds on the 3rd, 9th, 13th, 18th, and 19th. On the morning of the 20th the bar. fell to 28·26, and remained stationary for many hours. Temp. of first 16 days much above the average, that of the last 15 days much below. Mean of the month 33° above the average.

WIGSON.—The first fortnight temperature much above the mean for the month, the last ten days much cooler and frosty. 18th, very stormy, with L and H. 19th, much L in the evening. Bar. unusually depressed, 19th to 22nd inclusive.

BOSTON.—Temp. 3°·3 above the average; from the 21st Dec. to 19th Jan. mean temp. 44·7 or 8°·3 above mean of previous 9 years; during the whole of this



time the wind blew from the S.W., it then changed to N., bringing with it a sharp frost, the ther. falling on 21st to 22°; it remained cold to the end of the month, this being more sensible owing to a sharp E. wind. Bar. on the whole steady, but on the 19th a very remarkable depression without apparent cause. 16th, 30·00; 17th, 29·95; 18th, 9 a.m., 29·80, during the night it fell to 28·70 (1·10 in. fall), at the time strong gale of wind from S.W., with heavy rain. 19th, mercury remained steadily at 28·70; day very fine, with sunshine, and moderate wind from S.W., during the night it again fell, and on the morning of 20th stood at 28·44, the day being fine, frosty, with S.W. wind; about 11 a.m., it began gradually to rise again. This is the lowest reading for some years, except on 24th January, 1872, when the reading fell to 28·20. Tides very high at the latter part of the month, and springs held up much longer than usual.

GRIMSBY.—Some very mild and spring-like weather at the beginning of the month, much colder from the 18th to the end. Several gales (especially during the night) in the early part of the month; some very beneficial frosts succeeded. Gale, with T and L on 3rd. Aconite in flower, and blackbird whistling on the 8th, snowdrop in flower on 14th, many blackbirds whistling on 17th. Bar. fell to 28·35 at 10.25 p.m. on 19th.

DERBY.—This month has been remarkable for its varied barometric pressure; on the 20th it fell to 28·25, not merely the lowest of the month, but on two occasions only during the last 20 years has it fallen below this point. Temp. 3°·5 above the average.

ARNCLIFFE.—TS on 19th; aneroid fell to 27·00.

NORTH SHIELDS.—T on 4th, aurora on 5th, S and L on the 19th.

SEATHWAITE.—TS on 5th, and again on 19th, T on 7th.

#### W A L E S.

HAVERFORDWEST.—Up to the 20th not one fine day; a very wet month. Mild for January, although about the 18th the weather was very wintry, the hills covered with S, and there was a heavy TS with H. From the 27th to the end of the month was dry, cold, and very wintry, with a bitter E. wind; the month was also characterized by constantly recurring heavy gales, and great depression of barometer.

CEFNFAES.—The early part of the month wet, damp, and cloudy, with heavy fogs; the last nine days S, with frost. Prevailing wind S.E.

LLANDUDNO.—Gale in night of 2nd, and TS with H between 10 and 11 a.m. on 3rd; stormy, with hail showers, on 18th; TS, with S on 19th, H also on 20th, and 24th; snowdrops in flower on 13th, mezureum on 24th, and primroses on the 25th.

#### S C O T L A N D.

DUMFRIES.—Rain every day to the 20th, with frequent storms and heavy floods; the latter end of the month frosty; S on the 5th, 19th, and 20th. Both rainfall and temp. above the average for January.

HAWICK.—A very wet month; terribly stormy on the 18th, when the hills got covered with a thick sheeting of S, which they retained till the 29th.

ANNANHILL.—L on 2nd, T on 4th, H and S on 19th and 20th. Several fogs occurred in the month, and on the 20th a curious white vapour arose from the snow, evidently an exhalation caused by the excessive saturation of the ground from the heavy rainfall of 1872. Generally calm, but strong S.S.W. gale on 2nd and 3rd (66 miles miles per hour). Parish unusually healthy.

CASTLE TOWARD.—A cloudy and showery month, not one day without rain from the 1st to the 21st. Extremely high tides on the 3rd along canal shores; Prevailing winds S.W. to 21st; the latter part of the month rather frosty, with a few sunshiny days. On 19th a heavy fall of S, but the previous moist state of the ground prevented it from accumulating to any great depth. On Sunday evening, 19th, there were a number of fire flashes seen in the sky. [? Ed.] Cattle and sheep healthy; snowdrops in full bloom, and rhododendrons in the open air.

DEANSTON.—The first half of the month very wet, stormy, gloomy, and unfit for out-door work. Fall of four inches of S on 20th, which lay on the ground about a week, during which we had some hard frosts. Wind since generally easterly, and the weather more settled and dry, but very cold, and little sunshine.

**ABERDEEN.**—Mean bar. and rainfall below the mean of last 16 years; temp. above the mean; min. bar. 28·185 in. (corrected for temp. and sea level) on 19th; max. temp. in sun 70° on 24th, and min. on grass on 25th only 20°. L on 1st, 19th, 20th, and 29th; frequent frost and aurora. Except January, 1869, the past month was the mildest January for 17 years. A fine and comparatively dry month.

**CULLODEN.**—Min. bar., at midnight of 19th, 28·012, corrected to 32°.

**LOCHBROOM.**—A singular month of frost, floods, snow, and storms of hail, rain drift, T and L, with intense cold.

**PORTREE.**—Stormy and wet month, frequent gales. Very severe black frost on 29th, on to the end of the month. Sheep and cattle healthy.

**SANDWICK.**—January has been drier and 0°·8 warmer than the mean of the previous 46 years. On 19th the bar. stood lower than it has done for a number of years, 28·042, corrected for index error, but the weather during that and the following days was calm and fine; here, however, there were evident symptoms of a storm on the Atlantic, as it was in great fury on the two following days; gales on 8th, 14th, 15th, 26th, and 28th; T and L on 13th, and aurora on 10 nights.

### I R E L A N D.

**WATERFORD.**—A very vivid flash of L and long and loud T on 11th; sheet L on 18th, S on 20th and 21st.

**KILLALOE.**—The wettest January in 27 years.

**MONKSTOWN.**—Bar. very low on 19th, weather moderate.

**DOO CASTLE.**—Wet month, unfit for outside employment; great scarcity of fuel, which is beginning to be felt most severely.

**WARINGTOWN.**—Continuously wet until the last week, when easterly winds setting in we had some dry days.

**OMAGH.**—Up to 19th weather mild, at times unnaturally so; last ten days seasonable; ground so saturated as to cause a suspension of all tillage operations.

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### FREEZING RAIN.

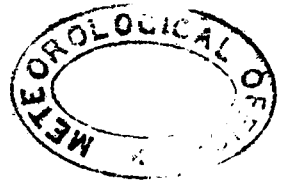
*To the Editor of the Meteorological Magazine.*

SIR,—We had a remarkable instance of freezing rain on Sunday afternoon (Feb. 2nd); during the previous night and early morning a deep snow-fall took place (·64 in. when melted), with a bitter easterly gale (min. temp. 28°·3); during Sunday temperature ranging from half a degree above to half a degree below 32°, wind strong, varying E.N.E. to E.S.E., then N.E., snow ceased towards noon, then small hail fell, resolving into a dribbling thin rain, which froze on the trees to the very tops till they were covered most beautifully in a coat of ice. I never saw such a beautiful sight before. There was a thaw and yet not a thaw, if you can understand; it seemed thawing on ground but freezing above, yet the temperature was just *above* the freezing point at 4 feet. The noise produced by the tree branches rubbing together in the gusty wind was most peculiar, like gaunt skeletons rattling together, or a hail-storm just commenced, a crackling rattle. The barometer fell very low, rose again by Tuesday to a point a little above what it read when the fall began, and yet a thaw immediately followed; since then travelling has been in slush. Lowest temperatures registered here, January 25th, min. air, 26°, grass 15°·2.

Yours truly,

F. EKLESS.

*Woolston Lodge, Southampton, Feb. 6, 1873.*



SYMONS'S  
MONTHLY

# METEOROLOGICAL MAGAZINE.

LXXXVI.]

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## THE LEIPZIG CONFERENCE.

Mr. Scott has rendered a service to many British, American, and Colonial Meteorologists, by the translation of the "Bericht über die Verhandlungen der Meteorologen—Versammlung zu Leipzig," which was published as a supplement to Dr. Jelinek's "Zeitschrift." We regret the time which has elapsed before it has appeared, but believe the responsibility thereof rests rather with the compilers of the Report than with the translator. But in any case it is a pity that half the time (available for discussion and experiment) between the Leipzig and Vienna conferences, has elapsed before many persons know what was done.

It was evident that the promoters cut out too much work for a sitting of only three days; the Conference discovered this early on the second day, and delegated to a committee the important subject of Marine Meteorology, and later in the same day two-thirds of the whole questions were referred to separate committees.

If the opinions of the Vienna Conference are to claim respect as the deliberate conviction of the ablest Meteorologists of the present day, steps must be taken to secure a much fuller discussion of each subject.

We by no means share the opinions of those who hold that the Leipzig Conference was a comparative failure because so little was finally settled; on the contrary, we agree with M. Buys Ballot, who, in opening the Conference, said that "it was of great interest to have received in writing the opinion of some of the most eminent men in Meteorological science," and we are sure that the report of the sayings of those present were of equal or greater value. Supposing that we were not one step nearer uniformity than before, we should still hold that the Conference was a success. Will any reader refer us to a meteorological publication, of the same size as the Report, which contains half as many useful hints as it does?

Efforts should be made to secure a more thoroughly cosmopolitan meeting at Vienna; only one representative of the New World was at Leipzig, Dr. E. H. Sell of New York, and he appears to have taken no part in the proceedings, while at least four-fifths of those present were Germans. We yield to none in our appreciation of what the Germans are doing for Meteorology, but they will recognize as readily

as any of our readers, that in an International conference, when votes on important points are to be counted, it is essential that some principle of weighting the votes be introduced. This may be done by limiting the number of representatives allowed to each country, or by giving to each representative a number of votes, regulated by the number of stations under his control.

This leads to another question. On the continent a majority of the stations are under Government control, and hence doubtless the rumour that the Vienna meeting is to be limited to "State Meteorologists." Englishmen, however, view matters differently; the native independence of the race finds its natural manifestation in wide-spread amateur research. Let anyone look over the roll of England's foremost men of science, and then say, if they can, that English Amateur Science needs no representative. Take Astronomy, what are De la Rue, Huggins, Lassell, or the late Lord Rosse but amateurs, yet would it be wise to exclude their opinions from any representation at an Astronomical Conference? And so with Meteorology; not only do the amateur stations altogether outnumber the official ones, but we do not know, either in this or any other country, any Government work which can be held superior to that of Colonel Ward, at Calne, Mr. Chrimes, at Rotherham, and Rev. C. H. Griffith, at Strathfield Turgiss, yet they are only amateurs, and therefore must be ignored. Surely the absurdity of a conference with many of the best men shut out would be too ridiculous to be persisted in.

Having thus expressed our opinion on the general conduct of the Conference, we proceed to epitomize the Report, which consists of five parts (1), the invitation and questions to be discussed; (2) list of persons present; (3) report of proceedings; (4) written replies; (5) Discussion on the questions at the Bordeaux meeting of the French Association for the Advancement of Science, Meteorological section.

This arrangement, although the proper, not to say the only one suitable as a record of proceedings, has the great disadvantage that it separates the remarks upon the several questions so much that complete information as to what was said, written and done, on any one subject, can only be ascertained by hunting all through the book. Take the question of thermometer stands; which is referred to on pages 6, 14, 15, 16, 17, 47, 49, 54, 56, 59, 65, 67. When we consider that among the principal speakers were Buys Ballot, Bruhns, Jelinek, and Wild, and among the writers, Dove, Mohn, Muhry, Wolf, and others, it cannot be inexpedient to take such steps as shall give to their opinions all the advantages which can be conferred by arrangement and concentration. We hope that the report itself is already in the hands of most of our readers, but we think they will nevertheless agree with us that it will be convenient to have it also in a systematically arranged and condensed form. Written opinions will be prefaced by the letter W (wrote), and verbal ones by the letter T (thought), and more attention will be paid to brevity and clearness than to grammatical accuracy of language.

With this brief introduction we proceed to question—

(1) *Is it desirable to introduce the same units of measure (viz. of length, degrees, and time) in meteorological inquiries in all countries, or is it sufficient to lay down certain fixed rules for the conversion of the different measures employed in the several countries?*

M. DOVE (W.) That the introduction of the centigrade scale was not advisable until the English and Americans gave up Fahrenheit's. In all the older tables, Fahrenheit's and Reaumur's predominate. Forbes's attempt to introduce the Centigrade at Chiswick failed. Fahrenheit's has the advantage of giving only positive quantities almost all over the temperate zone. Centigrade might be improved by adding 100 to it (*i.e.*, make freezing  $100^{\circ}$  and boiling  $200^{\circ}$ ). Sole inconvenience of Fahrenheit, is in inquiries as to distribution of plants, when readings above freezing are alone used.\* Metrical system would be awkward for barometers, as nearly all maritime nations use English scale.

Sr. F. de SILVEIRA (W.) Doubtless, Centigrade for thermometers, metric for barometers. If this cannot be done at once, mean and extreme results should be published in those scales.

M. CARL FRITSCH (W.) Very desirable, but can hardly ever be carried out; it is therefore unavoidably necessary to settle definite rules for conversion.

CAPTAIN HOFFMEYER (W.) In Denmark use only centigrade and millimetres.

Dr. MOHN (W.) Centigrade and millimeters.

Mr. SYMONS (W.) Identity of scale not necessary, but improved conversion tables are. Knows of none better than Guyot's, which in some respects might be improved.

BORDEAUX MEETING (W.) Uniformity highly desirable, but not attainable for many years; steps should therefore immediately be taken to secure conversion in publications of an international character.

M. BRUHNS (T.) The decision should be postponed until the result of the metric Conference at Paris was known.

Mr. SCOTT (T.) The Conference would waste time if it discussed a question which could only be settled by Governments; he thought England was less inclined to adopt the metric system than formerly; Fahrenheit degrees were convenient for telegraphy.

Mr. BUCHAN (T.) The question was important, but not vital, was in favour of metric scale, the Conference should recommend its adoption, and also the publication of conversion tables.

M. PRESTEL (T.) The metric system best, as it offers simple relations between linear and cubic units.

M. BUYS BALLOT (T.) That Mr. Buchan's proposal met the case, and that mean values should be given in the metrical scale as well as in the original whatever that might be.

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\* We do not see the force of this objection. Dove's words are, "Der einzige Uebelstand der Fahrenheit'schen Scala zeigt sich bei pflanzengeographischen Untersuchungen, weil man in diesen nur Zahlen benutzt, die den Frostpunkt übertreffen."

This proposal was adopted by the meeting.

(2). *What is the best form of barometer for stations of the second order? Is the use of Aneroids for such stations admissible?*

SR. F. da SILVEIRA (W.) Adie's mercurial, used for ships and for stations affiliated to the observatory—Aneroids only used temporarily.

M. CARL FRITSCH (W.) A very simple syphon barometer—Aneroids must not be used.

CAPT. HOFFMEYER (W.) Kapeller's station barometers, not aneroids.

DR. MOHN (W.) Aneroids not to be used for fixed stations.

PROFESSOR RAGONA (W.) Aneroid cannot be recommended, but might do for stations of the second order.

MR. SYMONS (W.) "Kew pattern," mercurial. Has a very high opinion of aneroids, but only when they can be frequently compared with a mercurial barometer.

BORDEAUX MEETING (W.) Mercurial only, but something cheaper than Fortin's. There are some with moveable cistern divided on glass at about £1 10s., others requiring only one reading, divided on glass or copper. M. Baudin has also announced one said to be very accurate and moderate in price.

M. BUYS BALLOT (T) hardly anyone would recommend aneroids for scientific purposes.

M. PRESTEL (T) the value of aneroids for scientific purposes should be discussed.

M. JELINEK (T) for stations of the second order aneroids were not bad, also for ship use, the ordinary marine barometer being too sluggish. The defects of aneroids may fairly be contrasted with difficulties in handling and suspending mercurial barometers.

MR. BUCHAN (T) That M. Jelinek's views were correct. Aneroids might be trusted for very short intervals of time, and even mercurial barometers occasionally got out of order. Considering the facility of transport and comparison, aneroids should not be taken out of the hands of meteorologists.

M. BRUHNS (T) Aneroids were not scientific instruments, but were often very useful. He proposed to refer the subject to a committee.

MR. SCOTT (T.) The aneroid is an instrument the error of which is constantly changing, and which therefore cannot be used at all. The more costly ones with thermometers were even worse than the others, for in certain cases the quicksilver of the thermometer destroyed the whole instrument.

M. VON FREEDEN (T.) Aneroids which give correct readings with mean pressures, fail with extreme ones, and in such cases undergo permanent change of corrections. He agreed with Mr. Scott.

M. WILD (T.) Aneroids should not be entirely rejected. They are at least good as interpolation and difference instruments.

M. MULLER (T.) Aneroids should not be used.

The President, M. BUYS BALLOT, summarised the discussion as

follows : "The aneroid should not be used instead of the mercurial, but only as an interpolation instrument in addition thereto." \*

M. BRUHNS suggested MM. Jelinek, Hann, and Buchan, as a committee to decide on a mercurial barometer for stations of the second class.

M. von OETTINGEN (T.) The matter too important to hand over to a committee.

M. WILD (T.) It was a bad plan to appoint a committee whose members lived in different countries. Eventually M. Hann was requested to undertake to report after consulting foreign authorities.

(3) *What mode of exposure of thermometers for the observation of air temperature is the best and most suitable for general adoption?*

SR. F. DA SILVEIRA (W.) they should be exposed to the free action of the wind, from every direction, sheltered from the sun, rain, and radiation, and protected by double louvered screens.

M. CARL FRITSCH (W.) They should be quite in the open air, about 6 ft. above ground. A wire should be stretched between two posts, and the thermometer hung from the middle. It will thus be exposed to rain, and sun, but if divided on its stem, and with a small cylindrical bulb the effect either of evaporation or insolation is slight, and compensatory. At all events disturbing influences are less than those of any screen or building (Cited Lamont's *Jahresbericht der kön. Sternwarte bei München* 1852, in support of his views).

CAPT. HOFFMEYER (W) In Denmark the thermometers are in a wooden louvered screen facing North.

DR. H. MOHN (W.) Stevenson's stand—In Norway the thermometers at the telegraph stations must be outside the windows, or the telegraph staff could not observe.

Prof. RAGONA (W.) draws a distinction between temperature in an open place, exposed to the sun (as a garden or terrace), and that outside a large window, facing north, in a lofty building, which he thinks the best place. Recommends that no more shelter from rain, &c., than is absolutely necessary be supplied, objects to double and triple louveres and roofs, also to aspirators, but is convinced a film of air adheres to a thermometer, which should be removed by gently fanning it.

MR. SYMONS (W.) Very elaborate experiments had been made in England upon the subject, of which he forwarded a description. He hoped the results would soon be published.

BORDEAUX MEETING (W.) One of the most delicate questions in meteorology. Differences of exposure affect extreme temperatures much more than means. In France thermometers generally sheltered by a double roof, sloping to south and about 3 ft. square; they are away from buildings, and placed about 6 ft. above grass. In other countries they are often placed in screens of louveres, &c., in which case the radiation of the sky is replaced by that of the screen. Uniformity cannot be

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\* We should be glad to have further evidence in support of the serious charges made against aneroids by several speakers. They differ much from our own experience.

expected at once; comparisons must be made both as guides for the future and correctives for the past.

Mr. BUCHAN (T) A very important question, including, as it did, the height of the thermometers above ground. No positive conclusions having been arrived at, suggested that statistics be collected from institutions and observatories relative to the height of the thermometers above the ground, and the methods by which they are protected, and a report thereon prepared for the Vienna Congress as a basis for discussion of the whole subject. In Scotland Stevenson's stand (over grass) is used.

Mr. SCOTT (T.) Stevenson's stands good, except in heavy snow. Glaisher's as good as useless. Mr. Buchan's proposal hardly practicable. Drew attention to a long series of observations by Mr. Griffith, which embraced 16\* modes of exposure, the observations being made several times daily, and whereof the results might soon be published.

M. BRUHNS, (T) comparative experiments should be made at central stations. Wished that directors of organizations present should describe the modes in use. Exposure at a window was usual in Saxony.

M. WILD explained the Swiss mode of exposure behind double cylinders of sheet iron, pierced with holes, and with louvred roof. But these must not be brought near heated walls, nor exposed to the sun; therefore in Russia they are further enclosed in a double wooden envelope to guard against the Northern winter sun, and against heat radiated from walls.

M. JELINEK explained the plan adopted in Austria. Although very desirable to give up exposure at windows, some attention must be paid to the convenience of observers, especially volunteers. He also called attention to M. Renou's proposed rotation thermometer.

M. VON OETTINGEN (T) In northern countries it was simply impossible to give up exposure at windows, and a compromise must be accepted.

M. EBERMAYER said his Government had given him ample funds to carry out any plan thought best. He thought complete trustworthiness could only be secured by Government support.

M. VON FREEDEN had tried Stevenson's screen, but his instruments being meddled with, he had now placed them in deep shade on the south side of his house, in a louvred screen, and read them with a telescope. He found they agreed with others mounted on the Prussian system.

M. RUHLMANS (T) An aspirator should be used; he had found it accurate.

BARON VON STERNBACH approved of the Austrian plan, the usual

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\* In the original this number was given as 20; in the English edition Mr. Scott says "the real number is 10, not 20."—It so happens that neither is correct—twelve are described on page 2 of Vol. IV. of this magazine, two new ones ("Shrubbery" and "Stow, No. 2") were supplied afterwards, and the conditions of two others altogether changed. An entirely different and specially constructed thermometer was added to the "Suspended" one, and both were raised from 13 ft. to 24 ft. above the ground, and "Stevenson" was moved from the experimental field to the N. side of the Rectory, in order to measure the effect of such a position.—G. J. S.



distance (3 feet) from the wall excluded its influence, and he had found the same temperature on all sides of his house.

Several speakers undertook to make comparative observations.

THE President, M. BUYS BALLOT pointed out that the only question was to determine local temperature accurately, and eventually MM. Scott, Wild, Jelinek, and Prestel were requested to investigate the various modes of exposure, and the debate was closed.

(4.) *What is the best construction of Maximum and Minimum Thermometers?*

SR. F. DA SILVEIRA (W) Negretti's max. and Rutherford's. min.

M. CARL FRITSCH (W) Walferdin's max. and Baudin's min.

PROF. RAGONA (W) Bellani's thermometer should be improved and used.

BORDEAUX MEETING (W) Walferdin's maximum is almost perfect when once in position, but it does not travel well. Negretti's travels perfectly but acts *per saltum*, the column rising by jerks of 0.004 to 0.008 in. Rutherford's minimum when properly made works well.

M. WILD (T) There is no maximum which does not get out of order but Geissler's is the best. Metallic thermometers are pretty good if often cleaned. Rutherford's minimum.

M. MÖHL uses a maximum thermometer with two glass rods, one behind the other.

M. EBERMAYER had found it faulty; Greiner's was perfect.

M. BRUHN (T) No maximum could be permanently trusted; the minimum was alone reliable.

MR. SCOTT (T) Negretti's maximum; Casella's mercurial minimum very beautiful but not quite trustworthy.

M. BUYS BALLOT (T) They might be trusted.

MM. VON FREEDEN & BEHRENS (T) The proper slope for each of these instruments must be ascertained.

The error in Rutherford's from condensation at the top of the tube was pointed out, and M. EBERMAYER said it could be avoided by altering the entrance of the tube into the bulb.

The discussion was summarized, (1) that the readings of self-registering should be frequently compared with standard thermometers; (2) that Rutherford's minimum was satisfactory; (3) that no maximum could be recommended for general adoption; and (4) therefore it was very desirable to devise a trustworthy one.

(5) *What instruments should be employed for determining the intensity of Radiation, and in what way can the comparability of the results obtained be secured?*

[We divide this into two parts, Solar and Terrestrial Radiation. Ed.]

#### SOLAR RADIATION.

SR. F. DA SILVEIRA (W) The black bulb maximum in vacuo.

PROF. RAGONA (W) An instrument described by himself in 1862, at the Polytechnic Association at Turin—viz., a Negretti's maximum kept at a right angle to the sun, but a heliostat driven by clockwork.

MR. SYMONS (W) Small bulb mercurial maximum thermometers with the bulb and one inch of the stem coated with dull black, in a vacuum jacket, mounted on a post, so that the bulbs are freely exposed to the sun, are the most comparable instruments.

BORDEAUX MEETING (W) Melloni's pile must be the sole standard of reference, but recommended for ordinary use black bulb vacuum thermometer, and that an ordinary [bright bulb? Ed.] thermometer also in vacuo, should be placed by its side. If possible each should be compared with a Melloni's pile.

#### TERRESTRIAL RADIATION,

SR. F. DA SILVEIRA (W) Black bulb minimum in vacuo, in focus of parabolic mirror.

BORDEAUX MEETING (W) Vacuum thermometers cannot be used for terrestrial radiation, obscure heat does not easily pass through glass, therefore it is the jacket, not the bulb, which is cooled. Recommend Melloni's pile.

M. WILD (T) Mr. Symons should be requested to report upon the modes adopted in England.

M. JELINEK (T) English physicists might be asked to institute experiments, and report. He would do so with the apparatus at the Central Anstalt.

MR. SCOTT (T) The difficulty was that at present different instruments were not comparable.

No decision reported.

6. *What instruments are the best for determining Earth Temperatures? At what depths should the observations be taken in order to obtain that uniformity which is desirable?*

M. CARL FRITSCH (W) Lamont's apparatus the best; thinks thermometers of ordinary dimensions should be used, sunk to any required depth, that the lowest should be in the stratum of constant temperature, and the others gradually at less intervals till the surface is reached.

CAPT. HOFFMEYER (W) intends to try Regnault's new air thermometer, (silver capillary tubes.)

BORDEAUX MEETING (W) The question must be considered as a question of terrestrial physics as well as in its meteorological aspect. As regards the first, it is mainly a question of cost, but a depth of 100 or 150 feet is necessary, and Becquerel's electric thermometer should be used. For Climatology, the temperature of the surface of the soil, and of the roots of plants is required. Suggest that thermometers 3 feet long and upwards should have a spare bulbless tube attached, so as to facilitate corrections for expansion of the column.

M. WILD (T) The same course of action should be taken as for the previous one, viz., to request a report from an expert.

MR. BUCHAN (at the request of Mr. SCOTT), explained that the method adopted in Scotland since 1856, had been to place thermo-

meters at 3, 12, and 22 inches deep, but this had mainly been done in the interest of agriculture.

M. VON OETTINGEN (T) That in order to avoid complication due to variety of soil, all observations for meteorological purposes should be made in soil of the same character.

M. EBERMAYER (T) Lamont's method the best, and referred for details to his forthcoming work on the influences of woods on air and soil. (*Die physische Einwirkung des Waldes auf Luft und Boden.*)

M. BRUHNS (T) The electrical should be used as well as Lamont's.

M. NEUMAYER had investigated the question at Melbourne, and referred for description of his method to "*Discussion of Meteorological and Magnetical Observations made at the Flagstaff Observatory, Melbourne. Mannheim, 1867.*"

No decision was come to upon this question, nor does it seem to have been referred to anyone.

## THE WINTER.

*To the Editor of the Meteorological Magazine.*

SIR,—At the end of last November (*see* p. 204 of your Magazine), I predicted that "the coming winter must be, on the whole, a mild or nearly a medium one," and that "the mean temperature of December to February, inclusive, would be in excess of, or about the average." I also said, "it seems almost certain that the mean temperature of February, 1873, will be below the Greenwich average of the last fifty years," and that "one of the intervals of sharp frost should occur in the early part of February." The winter has, on the whole, been mild. The mean temperature of December to February, inclusive, was  $1^{\circ}0$  above the Greenwich average of the last fifty years, but almost as low as the average of the last 25 years, and the mean of February (1873), was  $4^{\circ}7$  below the Greenwich average of the 50 year period. Sharp frost and snow occurred in the early part of February, and the minimum temperature in the south of England, was, according to Mr. Glaisher, as low as  $19^{\circ}6$  in the first week of the month.

GEORGE D. BRUMHAM.

*Barnsbury, March, 1873.*

## REVIEWS.

*Ozone and Antozone, their History and Nature; when, where, why, how Ozone is observed in the Atmosphere?* By CORNELIUS B. FOX, M.D. Edin., M.R.C.P. Lond., &c. 8vo, 301 pp., 31 Illustrations. Churchill.

DR. FOX dedicates this handsome volume to "the memory of the great and illustrious father of Ozonometry," Prof. Schönbein, and, on the whole, we think that had the Professor still been with us he would have highly appreciated the work. It is not perfect, but it is as nearly so as any one could have made it, and will, we think, at once secure for its author recognition as one of the foremost authorities on the subject. We are afraid to say how many "Ozone Committees" have

been appointed in this country alone, but we are sure of one point, namely, that Dr. Fox has done more to produce order out of chaos, and to substitute accuracy for uncertainty and fallacy than all the committees put together. It is quite beyond our scope to give even a *résumé* of this encyclopædic work, but we may briefly say that it fully answers each of the questions on its title, and brings together in one language and under one cover, a remarkable collection of what has been written on the subject both in the old and new worlds. We may here, *en passant*, refer Dr. Fox to the experiments with ozone tests in open and closed glass and metal tubes, and at different elevations above the earth's surface made by the Radcliffe Observer in 1867, and published in the "Oxford Observations," which seem to have escaped his vigilant search.

Dr. Fox, in addition to his wide acquaintance with the literature of his subject, has been an observer for some years, hence his opinion on the fourth head, "*How*" ozone is (and should be) observed, is of great value. In this chapter, however, he has stopped one step too soon. He has given us designs for aspirators, and he has told us where to get pure chemicals, and approximately pure paper, and how to prepare the tests, and then quietly writes—

"Where should ozone be observed? Everywhere."

We fear there is a great gulf between our author's instructions, as to the preparation of the tests, and the fulfilment of his wish, that ozone may be "everywhere," or even generally, observed. We cordially agree with nearly all Dr. Fox's views, and shall rejoice if really useful observations can be made by ordinary persons. Admitting all objections to Dr. Moffat's old tests, and to the mode of observing them, they had one great recommendation—they were made as nearly uniform as practicable, and we think that no wide-spread adoption of Dr. Fox's method can occur until he makes arrangements which shall place the preparation of the tests, and the construction of the aspirators, in the hands of some one responsible and competent person. Skill in observing, and in manipulative chemistry, though frequently, are by no means always, combined, and if extreme accuracy is within reach, the path thereto must lead through strict uniformity in the mode of preparation as well as observation.

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*Meteorological Report for the Year 1871.* Edited by the REV. R. F. WHEELER, M.A., and the REV. R. E. HOOPPELL, L.L.D., F.R.A.S. [From *Nat. Hist. Trans. of Northumberland and Durham*, Vol. IV. 1872.] Newcastle. J. Bell, and Co.

WE have nothing but praise for this excellent paper, which maintains its position as unquestionably the best of the local reports, and reflects equal credit upon its editors and the observers, while the public spirit of the club in maintaining so efficiently a publication which, from the excessive amount of tabular matter must be very expensive, should not pass without due recognition. As a storehouse of facts, all most excellently arranged, it has no equal, and the Editorial notes are so

good as to make us regret that they are so brief. We have a suspicion that the Editors find the preparation and verification of all the returns makes such demands on their time that they are unable to find leisure for those generalisations which the scientific attainments and local knowledge of the Editors would render of great value. Should this be the case, we venture to suggest that it would be to the interest of Science, of the club, and of the Editors that some of the purely routine work should be taken off their shoulders.

## METEOROLOGICAL OBSERVATIONS AT PATRAS.

*To the Editor of the Meteorological Magazine.*

SIR,—I am very glad to be able to send you once more some information as to the meteorology of Greece. I enclose tables of the rainfall, temperature, cloudiness, and earthquakes at Patras during the year 1872, upon which, as they will occupy considerable space in your pages, I will offer but few words by way of comment.

An unfortunate gap occurs in the table of minimum temperatures, for my minimum thermometer got broken, and it was not till the end of September that I procured a new one.

*Rainfall.*—This has been much below the average; every month excepting April, and perhaps also January and May, showing a greater or less deficiency. Since, however, the autumn rains of 1871 had been very heavy, there was no lack of water here last summer; but the autumn rains of 1872 have been so scanty that, unless the approaching spring proves much wetter than any I have yet seen, we have cause to fear a drought in the coming summer.

*Temperature.*—The year has been as remarkable for heat as for dryness. None of the months were at all colder than usual, while March, May, and September, were most unusually warm. Hot dry winds, charged with African sand, made March a most unpleasant month. In the middle of May came a spell of extraordinary and merciless heat; while September, instead of refreshing us after the heats of July and August, was, in reality, but little cooler than they, and to our feelings very much worse. October and November were also much above the average, and it was only the last few days of December that even pretended to be cold, and these, with maxima between  $55^{\circ}$  and  $60^{\circ}$ , and minima from  $36^{\circ}$  to  $41^{\circ}$ , with absolutely cloudless skies, and wind scarcely perceptible, made Christmas weather which you in England would have envied.

*Clouds.*—Observation of clouds is a source of much perplexity to me. I find it most difficult to apply rightly in this country the terms "cirrus," "cumulus," &c. Sometimes there may be seen at one view all varieties of cloud from cirrus to nimbus, each of the principal mountains in sight enjoying weather peculiar to itself. I have recorded every morning the general impression left upon me in the course of the preceding day, and from this record the subjoined table has been constructed.

*Earthquakes.*—These have been neither severe nor numerous this

[illegible]

*Table of Rainfall for 1872.*

Day	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	..	..	..	..	..	..	..	..	..	..	..	..
2.....	..	..	..	..	..	·05	..	..	..	·10	..	..
3.....	..	..	..	1·08	..	..	..	..	..	..	..	..
4.....	..	..	..	·15	..	..	..	..	..	..	·06	..
5.....	..	..	..	..	..	..	..	..	..	..	..	·58
6.....	..	..	..	·10	..	..	..	..	..	..	..	..
7.....	..	..	..	·26	..	·02	..	..	..	..	..	..
8.....	..	..	..	·06	..	..	..	..	..	..	..	·04
9.....	1·12	..	..	·06	..	..	·04	..	..	..	..	..
10.....	1·29	·03	..	·47	..	..	..	..	..	..	..	·05
11.....	·07	..	..	·01	..	·01	..	..	..	·98	·35	·36
12.....	·10	..	..	..	..	..	..	..	..	..	·28	..
13.....	..	·70	·21	..	·20	..	..	..	..	..	·03	..
14.....	..	..	..	·03	..	..	..	..	..	..	..	·46
15.....	..	..	..	·02	..	..	..	..	..	..	·79	..
16.....	..	..	..	..	..	..	..	..	..	..	..	·12
17.....	..	·18	..	..	..	..	..	..	..	·02	·16	..
18.....	..	..	..	..	..	..	..	..	..	·76	..	·65
19.....	·03	..	..	..	..	..	..	..	..	..	..	·57
20.....	..	..	·10	..	..	..	..	..	..	..	..	·80
21.....	·01	..	·18	..	..	..	..	..	..	..	·04	..
22.....	..	..	..	..	..	·04	..	..	..	..	..	..
23.....	..	..	..	..	..	..	..	..	..	..	..	..
24.....	..	..	..	..	..	..	..	..	..	..	..	..
25.....	..	..	·56	..	..	..	..	..	..	·45	..	..
26.....	..	·51	..	..	..	..	..	..	..	..	..	..
27.....	..	·19	·14	..	·07	..	..	..	..	..	..	..
28.....	..	·01	..	..	·06	..	..	..	..	..	..	..
29.....	·14	..	..	..	..	..	..	..	..	..	·04	..
30.....	·23	..	..	..	..	..	..	..	..	·35	·13	..
31.....	..	..	..	..	·18	..	..	..	..	..	..	..
	2·99	1·62	1·19	2·24	·51	·12	·04	..	..	2·66	1·88	3·63

Total Rainfall of the year..... 16·88 inches.

Rainy days...	8	6	5	10	4	4	1	0	0	6	9	9
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Total Number of Rainy Days..... 62

*Table of Earthquakes in Patras in 1872.*

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
12 .		8 .	3 .		25 .	4 .						28 .
13 .		19 .	19 .			11 .						
18 .	.....					12 ..						
21 .												
25 .												
31 .												

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

*Table of Cloud at Patras in 1872.*

Number of days in which there appeared	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Cloud obscuring the sky entirely, or nearly so, all day .....	9	7	4	4	1	..	..	...	...	2	4	6
Clouds of various density and extent scattered over the sky .....	14	15	12	17	14	11	8	7	1	19	19	13
No clouds at all, or but a few small ones on the mountains, or on the horizon .....	8	7	15	9	16	19	23	24	29	10	7	12

### THE SNOW IN FEBRUARY.

The following letters read in conjunction with those in our usual notes on pages 35 and 36, will place our readers in possession of the leading features of the remarkably heavy fall of the 2nd.

**BROMLEY.**—Snow fell here on an average six inches deep on 25th, but not a vestige remained on 26th.—*A. Rawson.*

**SIR,**—We had a heavy fall of snow here yesterday, February 2nd, all through Saturday night and Sunday morning. It was very stormy—roads blocked up so that the post-cart had to be left behind, and the bags brought forward on horseback. Wind east, but somewhat changeable. Thermometer dropping to 24° through the night, barometer 28·8., this morning it was 29·2, and still rising. Now, towards three o'clock it is close upon 29·4, thermometer at 28°. Have now hopes of getting our ice-house filled yet; we have had nothing like this snow-storm for years.

T. C. ELLIOT.

*Melbury House Gardens, Dorchester, February 3, 1873.*

**DARTMOOR.**—Heavy snow storm on the 1st and 2nd; no communication with railway, no post, locomotion impossible, the drifts being excessively deep. On 21st, heavy mist, which froze as it fell. Strange and beautiful phenomenon on 24th; snow all night, at 11 a.m. raining hard, freezing as it fell; at 6 p.m. all the snow, and portions of the ground where there was no snow, were coated over with continuous sheets of frozen rain, more than half-an-inch thick. Snow drifted in some places 12 feet deep; forked lightning on the 26th, and sheet lightning on the 27th, but no thunder.—*R. E. Power, M.D.*

**SIR,**—Enclosed is an extract from a letter from the Rev. J. B. Riky, the rector of Bagborough, a village  $7\frac{1}{2}$  miles N.W. of Taunton, dated February 7th, describing the snow-storm of Sunday the 2nd. It is confirmed by my gardener at Halse, 5 miles to the S.W. of Bagborough, who says that in the open fields the snow lay 2 feet deep, and where it was drifted, 5 or 6 feet, and that the farmers had all their men employed on Sunday in digging out the lambs.—Yours faithfully.

R. C. A. PRIOR.

*48, York-terrace, N. W., February 10, 1873.*

"The snow which fell on the 2nd has drifted to such an extent about here that we have been unable to use our roads. Gradually they are



being dug out, but even now our Taunton road is quite impassable except on foot. I walked down it on Monday with three of my children, thinking they might live years before they might see such a sight again. It was truly grand, and delighted them beyond measure. We walked on the snow quite level with our high hedges. The mail-cart is still unable to pass."

SIR,—I sent you, a few days ago, some account of the unusually heavy snowstorm west of Taunton on the 2nd of February. My gardener writes yesterday from Halse, seven miles west from it :—"We did not get our letters all last week till 11 o'clock instead of half-past seven. The snow was so deep that the mail-carts could not travel. It will take a week more now before it is all gone."—Yours obediently,

February 13, 1873.

R. C. A. PRIOR.

SIR,—My gardener writes from Halse—"We have again had a heavy fall of snow. It began on Sunday and continued till Tuesday morning, and lay two feet deep." I enclose part of a letter from another friend residing at Milverton, dated Feb. 19th, respecting the storm of the 2nd.—Yours, &c.

R. C. A. PRIOR.

48, York Terrace, N. W., Feb. 27, 1873.

"We have had here a heavier fall of snow than has been known in the memory of man, and to give you some idea of it, I may mention the snow drifts are so deep in some places, that I had the greatest difficulty yesterday (now sixteen days since its fall), in cutting my way through between Nynhead and Langford, and for days the roads, in consequence of the drifts, were quite impassable."

CLONMEL.—On 1st. a violent snow storm, commencing at 3 p.m., and continuing until 9 a.m. on 2nd. Snow about 16 inches deep, but drifted to the height of 3 and 5 feet in the streets, and in parts of the open country to 10 or 12 feet. Nothing like it here since 27th January, 1855. Wind due east.—*J. H. Grubb.*

# INTENSE FROST ON FEBRUARY 24TH.

*To the Editor of the Meteorological Magazine.*

SIR,—I forward particulars of a noteworthy frost, as registered here :—

Temperature in the Shade.

			Min.			Max.
Feb. 23rd	...	...	18·2	...	...	33·1
„ 24th	...	...	3·6	...	...	34·9
„ 25th	...	...	9·7	...	...	42·5

Four inches of snow fell on the 23rd, and one inch on the 24th. Rain, to the amount of 0·32 in. was registered for the 25th.

The minimum of the 25th was in reality a second minimum for the 24th, as the temperature indicated was observed as occurring at 8 p.m. on the latter day, and the true minimum for the 25th would not be lower (probably) than 15·0°.

My thermometers are suspended on a modified Pastorelli stand, four feet above the ground.

T. B. ARMITSTEAD, B.A., F.M.S.

*The Parsonage, Garstang, Lancashire.*

## 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.
- Meteorological Observations, Toronto, January to June, 1872.* By G. T. KINGSTON, M.A., Director.

## HIGH BAROMETER ON FEBRUARY 18th.

We seem to be passing through a period when extremes of all kinds are unusually frequent. We had last year an amount of rain in many cases unprecedented. On January 19th and 20th the barometer was lower than it had been, with one exception, for a dozen or more years, and now within a month we have to record 30·826 in., against 28·165, or taking the average of all England, we have on the morning of January 20th about 28·4, and on that of February 18th 30·75.

As in the case of the January depression, so in the present case of unusual elevation, it was a movement extending over a large part of Europe, and therefore unaccompanied by strong winds, or what may be called local features. It is true the pressure did not quite reach the same extreme point at all places, but the differences were not large. It appears from the data we have received, that in the early morning the highest point was in the neighbourhood of Huntingdonshire, and that it passed down south-eastwards towards noon, giving the extreme readings at London at Tunbridge Wells of 30·826 and 30·825 respectively.

We add a few of the highest readings on February 18th :—

Div.	County.	Station.	Hour.	Sea Level Pressure.
I.	Middlesex .....	Camden Square* .....	11.0 a.m.	30·826
II.	Kent.....	Royal Observatory .....	9.0 "	30·803
"	" .....	Parkside, Beckenham ...	9.0 "	30·791
"	Sussex .....	Worthing .....	9.0 "	30·773
"	" .....	Brighton .....	9.0 "	30·801
"	" .....	Crowboro' Beacon Obs...	8.0 "	30·825
"	Hampshire .....	Strathfield Turgiss .....	9.0 "	30·788
III.	Cambridge .....	Merton Villa, Cambridge	9.0 "	30·790
V.	Somerset .....	Paragon, Bath .....	9.0 "	30·771

As it is convenient to many to have lists of extremes available for comparison, we have compiled the following tables. Not having the air temperature at Greenwich at the time of all the maxima, we have applied as a constant correction that due (for 159 feet) to 30·5 in. at an air temperature of 40°.

\* At 9 a.m., 30·790.

BAROMETRIC MAXIMA.  
*Royal Observatory, Greenwich.*

Year	Date.	Hour.	Pressure at 159 ft.	Pressure at sea level.	Year	Date.	Hour.	Pressure at 159 ft.	Pressure at sea level.
1840	Dec. 27	8.0 a.m.	30.558	30.738	1856	Jan. 13	10.0 a.m.	30.550	30.730
1841	Mar. 11	10.0 "	.388	.568	1857	Nov. 12	9.0 "	.609	.789
1842	Nov. 18	10.0 "	.470	.650	1858	Jan. 17	10.30 "	.557	.737
1843	Jan. 19	10.0 "	.437	.617	1859	Jan. 9	10.50 p.m.	.640	.820
"	Dec. 14	10.0 "	.437	.617	1860	Feb. 14	9.45 a.m.	.434	.614
1844	Mar. 29	10.0 "	.418	.598	1861	Feb. 2	noon.	.544	.724
1845	Mar. 22	2.0 "	.376	.556	1862	Feb. 8	9.0 p.m.	.495	.675
1846	Jan. 9	10.0 "	.543	.723	1863	Feb. 13	11.30 a.m.	.523	.703
1847	March 4	0.0 "	.404	.584	1864	Nov. 6	7.15 p.m.	.496	.676
1848	Jan. 12	0.0 "	.374	.554	1865	Dec. 15	10.30 "	.610	.790
1849	Feb. 11	9.0 p.m.	.715	.895	1866	Jan. 25	10.30 a.m.	.506	.686
1850	Dec. 23	noon.	.482	.662	1867	March 2	11.50 "	.618	.798
1851	Sept. 16	9.0 p.m.	.466	.646	1868	Nov. 13	10.0 "	.471	.651
1852	March 6	9.0 "	.655	.835	1869	Dec. 5	11.25 p.m.	.410	.590
1853	Nov. 9	noon.	.414	.594	1870	Jan. 18	11.0 a.m.	.466	.646
1854	March 4	9.0 p.m.	.669	.849	"	Dec. 2	10.15 "	30.466	30.646
1855	Jan. 12	9.0 p.m.	30.483	30.663					

*Camden Square, Middlesex.*

Year.	Date.	Hour.	Pressure at sea level.	Year.	Date.	Hour.	Pressure at sea level.
1858...	Jan. 17	9.0 a.m.	30.699	1866...	Jan. 25	9.0 a.m.	30.663
1859...	Jan. 9	11.40 p.m.	.830	1867...	March 2	9.0 "	.788
1860...	Feb. 14	9.0 a.m.	.624	1868...	Nov. 13	9.0 "	.653
1861...	Feb. 2	0.30 p.m.	.729	1869...	Dec. 6	9.0 "	.589
1862...	Feb. 8	8.30 "	.690	1870...	Dec. 1	9.0 p.m.	.628
1863...	Feb. 13	9.0 "	.693	1871...	Dec. 12	9.0 a.m.	.520
1864...	Nov. 6	9.0 "	.690	1872...	April 6	9.0 p.m.	.473
1865...	Dec. 15	9.0 "	30.782	1873...	Feb. 18	11.0 a.m.	30.826

G. J. SYMONS.

*Beckenham, Kent.*

1867...	March 2	...	30.759	1871...	Dec. 8	...	30.515
1868...	Nov. 13	...	.621	1872...	April 7	...	.519
1869...	Dec. 6	...	.578	1873...	Feb. 18	...	30.791
1870...	Dec. 2	...	30.625				

C. O. F. CATOR.

*Uckfield, Sussex.*

1854...	Mar. 5	...	30.579	1863...	Feb. 13	...	30.725
1856...	Jan. 13	...	.721	1865...	Dec. 16	...	.725
1857...	Nov. 12	...	.770	1867...	March 2	...	.757
1858...	Jan. 17	...	.726	1873...	Feb. 18	8.0 a.m.	30.825
1859...	Jan. 10	...	.824				

C. L. PRINCE.

*Paragon, Bath, Somerset.*

1852...	March 6	...	30.787	1861...	Feb. 2	...	30.792
1859...	Jan. 3	...	30.806	1873...	Feb. 18	9.0 a.m.	30.771

C. S. BARTER.

## FEBRUARY, 1873.

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.		
inches.	inches.	in.				Deg.	Date.	Deg.	Date.	In shade	On grass.	
I.	Camden Town .....	1·96	+·74	·61	2	13	50·1	26	25·8	25	19	22
II.	Maidstone (Linton Park).....	2·24	+·73	·49	25	13	51·0	14*	25·0	2,25	24	...
III.	Selborne (The Wakes).....	2·60	+·89	·92	25	12	48·2	26	23·0	25	23	24
IV.	Hitchen .....	1·64	+·38	·28	25	15	47·0	26	23·0	22	25	...
V.	Banbury .....	1·50	+·07	·29	26	15	48·0	26	24·0	2	24	...
VI.	Bury St. Edmunds (Culford).....	1·88	+·46	·50	3	11	50·0	26	21·0	22	23	26
VII.	Bridport .....	3·17	+1·11	·77	24	11	51·0	26	26·0	25	15	...
VIII.	Barnstaple.....	2·29	+·21	·78	24	9	50·5	26	29·5	24	...	...
IX.	Bodmin .....	4·95	+2·16	1·50	1	15	53·0	25	28·0	11	9	13
X.	Cirencester .....	1·63	+·02	·34	23	11	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall) .....	·94	+·05	·25	2	11	47·0	26	20·0	23	22	...
XII.	Tenbury (Orleton) .....	1·02	+·55	·24	24	15	51·8	26	24·8	25	18	19
XIII.	Leicester (Wigston) .....	1·74	+·40	·44	25	9	50·0	26	20·0	22	20	...
XIV.	Boston .....	1·68	+·47	·42	3	14	49·0	26	23·0	26	19	...
XV.	Grimsby (Killingholme) .....	1·68	...	·42	3	18	49·0	26	19·0	25	9	...
XVI.	Derby.....	·68	—·80	·15	24	11	50·0	26	22·0	23	18	...
XVII.	Manchester .....	·67	—1·28	·16	26	11	...	...	...	...	...	...
XVIII.	York .....	1·28	+·10	·32	25	13	45·0	16	10·0	25	18	...
XIX.	Skipton (Arncliffe) .....	1·27	+2·40	·52	26	9	...	...	...	...	...	...
XX.	North Shields .....	1·91	+·38	·43	3	16	45·9	20	17·7	24	12	16
XXI.	Borrowdale (Seathwaite).....	3·05	+8·33	1·61	25	4	...	...	...	...	...	...
XXII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest .....	3·76	+·90	·96	28	10	50·0	22§	27·0	12	16	21
XXIV.	Rhayader (Cefnfaes).....	2·26	+·72	·70	25	5	50·0	...	21·0	...	...	...
XXV.	Llandudno .....	1·23	—·12	·25	25	11	50·5	20	25·6	25	9	...
XXVI.	Dumfries .....	1·07	+1·48	·92	25	2	50·0	20	15·5	24	15	22
XXVII.	Hawick (Silverbut Hall) .....	1·18	...	·51	26	10	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill).....	·62	...	·27	25	7	48·0	14	18·2	4	24	...
XXIX.	Castle Toward .....	1·77	+1·97	1·05	26	6	50·0	20	19·0	24	16	...
XXX.	Leven (Nookton) .....	1·13	+·57	·52	25	11	51·0	14	19·0	24	20	27
XXXI.	Stirling (Deanston) .....	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Logierait .....	·75	...	·43	25	5	51·0	18+	11·0	24	19	...
XXXIII.	Braemar .....	·87	+1·11	·25	2	6	47·8	20	8·0	8	18	28
XXXIV.	Aberdeen .....	1·72	...	·28	2	20	47·2	21	12·7	25	20	21
XXXV.	Inverness (Culloden) .....	·82	+1·06	·36	6	9	46·1	19	22·0	25	11	21
XXXVI.	Portree .....	2·05	+8·18	·38	26	18	...	...	...	...	...	...
XXXVII.	Loch Broom .....	2·36	...	·39	4	15	...	...	...	...	...	...
XXXVIII.	Helmsdale .....	1·54	...	·37	22	14	...	...	...	...	...	...
XXXIX.	Sandwick .....	1·54	+·94	·34	23	17	48·1	19	17·3	25	12	19
XL.	Caherciveen Darrynane Abbey .....	...	...	...	...	...	...	...	...	...	...	...
XLI.	Cork .....	1·46	...	...	...	...	...	...	...	...	...	...
XLII.	Waterford .....	...	...	...	...	...	...	...	...	...	...	...
XLIII.	Killaloe .....	2·01	+·90	·79	28	8	50·0	25	21·0	4	12	16
XLIV.	Portarlington .....	·49	+1·54	·09	25	14	49·0	20	21·0	2	18	...
XLV.	Monkstown .....	·75	+·89	·22	28	8	48·0	17	21·0	3	12	...
XLVI.	Galway .....	1·51	...	·53	28	12	51·0	21+	22·0	4	15	...
XLVII.	Bunninadden (Doo Castle) .....	1·02	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown .....	·74	...	·23	25	8	51·0	20	12·0	23	22	23
XLIX.	Edenfell (Omagh).....	·77	...	·26	25	10	47·0	20	12·0	23	17	...

\*And 15. †And 20. ‡And 26. §And 25. ||And 20, 24 &amp; 27.

+ 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 very dull month, first and last weeks wintry, the ground being covered with snow; frost never severe, though frequent, winds mostly N. and N.E., but often changeable, never high except on 25th. The most remarkable feature being the almost total absence of sunshine during the whole of the month.

SELBORNE.—Prevailing winds first three weeks N.E., the last week variable; altogether the coldest February but one in the last thirteen years. A foggy, comfortless, unhealthy month, and very hindering to farm and garden operations. Fog every day from 14th to 25th; very thick on 20th; faint aurora on 23rd. Ther. rose from 23° to 44° on 25th, all the S melted by the evening; aurora on 26th, brighter than that on the 23rd.

HITCHIN.—On the 2nd the heaviest S for 25 years.

CULFORD.—A month of very wintery weather; frost on the grass on every morning excepting those of the 25th and 26th. The mean temp. of the month below that of the preceding January 34°·4 to 40°·4. S on 9 days, Polar winds on 6 days, and equatorial winds on 22 days.

BRIDPORT.—Heavy S on 1st and 2nd; S in main road 10ft. to 15ft. deep. The month has been remarkable for the prevalence of northerly winds and high bar.

BODMIN.—S and R, with strong S.E. winds on 1st and 2nd. Temp. 4°·4 below the average; rainfall considerably above it.

HAUGHTON HALL.—The driest month since November, 1871, and the coldest February since 1865, in both of which years the temp. exceeded 32°·0 only on six nights, the average of 1865 being 30°·7, that of 1873 31°·0. Great fluctuation in the bar. A severe day on the 2nd; S, with strong easterly wind, forming drifts, which lasted till the 23rd, during which time the wind came from W. and N.W. The night of the 23rd the coldest this winter, ther. going down to 20°·0. A wonderfully bright meteor in N.N.W., 10 p.m., on 3rd. The ground, previously so saturated, became dry enough by the 15th for the farmers to plough.

ORLETON.—A very cloudy, gloomy, and cold month, but generally dry; temp. nearly 6° below the average; frequent light falls of S; about 3 in. deep on the 25th, and much drifted on the 2nd and 3rd; bar. very high on the 18th, and low on the 26th. L in the S.S.W. after dark on the 27th, with clear sky and frost; the wind frequently very rough.

WIGSTON.—A wintery, seasonable month, the mean temp. has been 8° below that of February, 1872, which has proved beneficial in checking vegetation. Agricultural work very backward.

BOSTON.—Temp. 5° below the average of previous 8 years; the period from 23rd to 26th one of great atmospheric disturbance, the temp. ranging 26°, the mean on the 26th being 49°, min. on 25th and 26th being 23°. The air was very dry.

KILLINGHOLME.—2nd and 3rd cold and unpleasant; mid-day temp. 31°. The greater part of month cold and ungenial; the third week had some very pleasant days; the frosts have thoroughly pulverised the ground, and been very beneficial both in that way and in retarding the blossoms of the wall-fruit trees.

DERBY.—A most welcome and necessary month, as farming operations, so long delayed, have now had scarcely a day's interruption.

YORK.—S on 3rd, 11th, 23rd, 24th, 25th, and 27th.

N. SHIELDS.—Lunar halo on 13th; S on several days.

SEATHWAITE.—Remarkably dry month.

## WALES.

HAVERFORDWEST.—1st February severe gale from the east, after which a blinding snow set in, with the temp. as low as 27°. On Sunday morning the drifts were of great depth, in some places varying from 5 to 20 feet, completely blocking up the roads, while, in other parts, they were quite clear and dry with hard frosts;

and not a particle remained in the gauge ; from measuring the S in several places, and considering the extent of the drifts I estimated it at '90 in. at least. There was another heavy fall on 23rd and 24th, of which a large quantity was lost by being blown over the gauge ; '12 in. and '40 in. was the quantity melted in the gauges ; a sudden and rapid thaw then succeeded the S, frost again returned and was followed by heavy rain from the S.E., and '96 of R fell on the last day. Bar. 30'69 on 18th, and 28'78 on 26th. Sharp frosts on 16 nights, with north-easterly winds ; the month was cold and wintry throughout.

CEFNFAES.—The month has been cold, much S ; wind generally N.E. or S.E.

LLANDUDNO.—S on the hills, but a dry, seasonable month on the whole.

#### SCOTLAND.

DUMFRIES.—Frost was prevalent for the first half of the month, a few mild days followed, then frost returned in the last week of the month, with S on 23rd, 25th, and 27th ; the temp. on the morning of the 24th was at 15°·5, the lowest since December, 1870. The fall of rain was greatly below the average, and the temp. was also far below that of the corresponding month of last year.

HAWICK.—A frosty month, with frequent falls of S.

KILMARNOCK.—Mean temp. 5° below that of January, frost lasted nearly the whole month. Mean horizontal movement of air, 8 miles per hour. Stock healthy. Much ground ploughed, and if the weather keeps fine, sowing will be general in March ; very little wheat was sown last autumn owing to bad weather. Death-rate in Kilmarnock nearly twice that in January—31 per 1000 against 19—the excess mainly arising from consumption and bronchitis.

CASTLE TOWARD.—A dull, overcast, sunless month, with 24 frosty nights, and temp. as low as 19°·0 ; wind varying from N.E. to N.W. On 25th heavy fall of S filled our ice-house ; on the 4th and 5th ice in good order. Cattle healthy, vegetation beginning to show itself.

LOGIERAIT.—Much frost, with an interval of unusually fine weather between 15th and 20th.

ABERDEEN.—Mean bar. 0·253 in. above the average of 16 years ; mean temp. 35°·1 or 2°·7 below the average, and only twice during the 16 years was the mean temp. lower than in this month ; lowest mean temp. on grass 23°·6 ; min. of month, 12°·7 in air and 2°·4 on grass on 25th. A cold, dry, and rather fine month, notwithstanding two rather sharp snow storms, one at the beginning and the other at the end of the month ; frequent auroræ ; 18th, temp. in sun 91°·7.

PORTREE.—A very cold month, with much more frost and S than usual ; frost very severe on 24th, milk frozen with ice one-eighth of an inch thick at 9 a.m. ; much less rain than usual in February.

LOCHBROOM.—This has been on the whole a very severe, frosty month, and one of the heaviest snow storms that we have had for years began on the 22nd, and continued a whole week, accompanied with intense frost.

SANDWICK.—February has been 1°·7 colder than the mean of the previous 45 years, and drier than the mean of 32 years. Frost and snow from 22nd till the 1st of March. Auroræ on six nights. Gales of 40 miles an hour on 1st and 11th from 9 till 11 a.m., and from 5 p.m. on 17th to 1 a.m. on 18th ; gale 50 miles an hour from 4 p.m. on 21st, to 2 a.m. on 22nd.

#### IRELAND.

MONKSTOWN.—A very cold, dry February. Very hard frost on 3rd ; temp. 21°·0.

DOO CASTLE.—Remarkably free from rain ; fine month, resembling advanced spring weather. A few days of severe frost towards the beginning.

WARINGTOWN.—Very fine and favorable to farm labour ; a great quantity of wheat sown, and the land thoroughly dried in consequence of the first week breaking up without rain.

OMAGH.—Min. temp. 12° on night of 23rd, the lowest since January, 1867, but the month, though cold, has been the finest February for many years, and the arrears in tillage operations, caused by the wet autumn, have almost been made up.

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[We regret that the pressure on our space compels us to defer till our next, several important letters.—ED.]



SYMONS'S  
MONTHLY  
METEOROLOGICAL MAGAZINE.

LXXXVII.]

APRIL, 1873.

[PRICE FOURPENCE,  
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THE LEIPZIG CONFERENCE.\*

(Continued from page 25.)

THE article in our last number contained an abstract of the written and spoken opinions on only six questions out of the twenty-six, and as these had taken nearly half the entire time at the disposal of the Conference, it was wisely resolved that questions 7 to 17 should be referred to a sub-committee, consisting of MM. Ebermayer, Prestel, Schoder, and M. Hann as reporter. It will therefore be understood that statements regarding questions 7 to 17, reported to be by the Committee, are upon the authority of the above-named gentlemen.

7. *What apparatus should be employed for the determination of the hygrometric condition of the air? Are the wet and dry bulb thermometers sufficient? Can the hair hygrometer be employed, and under what restrictions?*

Sr. F. DA SILVEIRA (W.) Psychrometer† for continuous observations. The hair hygrometer can never be accurate when exposed to the atmosphere.

M. CARL FRITSCH (W.) Psychrometer sufficient, and preferable to hair hygrometer. Thinks observers are not sufficiently careful to see that the wet bulb is really wet.

CAPT. HOFFMEYER (W.) Knows of nothing better than dry and wet bulb.

Dr. MOHN (W.) Convenience of observers must be studied, and psychrometer is most convenient, but for low temperatures hair hygrometer must be used with it.

Prof. RAGONA (W.) Strongly recommends a psychrometer by Tecnomasio Italiano, in Milan. Calls attention to observations by Belli and Cantoni, showing that the results of thermometers with spherical bulbs covered with linen and moistened by a wetted wick, are unreliable. Believes hair hygrometer to be trustworthy if originally set by a psychrometer; recommends it to be enclosed in wire gauze.

\* Report of proceedings of the Meteorological Conference at Leipzig. Published by authority of the Meteorological Committee. Stanford. 1873.

† Continental term for dry and wet bulb hygrometer.

Mr. SYMONS (W.) Does not consider dry and wet bulb perfect, but preferable to Saussure's hair hygrometer.

Dr. WOLF (W.) Psychrometer always wrong when frost and thaw alternate rapidly ; hair hygrometer should therefore be used as a check.

BORDEAUX MEETING (W.) Psychrometer good in hot countries, but fails at low temperatures. Hair hygrometer as ordinarily made is bad, the hair being at too great tension. Whatever instrument is used should be compared with some standard.

The COMMITTEE (T.) The psychrometer faulty at low temperatures and in cases of extreme dryness, the hair hygrometer erroneous at the dew point, and that further experiments should be made and experience collected.

M. NEUMAYER (T.) Regnault's hygrometer, with an aspirator, should be used.

M. VON OETTINGEN (W.) Had found Regnault's fail at very low temperatures.

Mr. SCOTT described Mr. Whitehouse's sulphuric acid hygrometer.

M. WILD had directed the use of the psychrometer *and* hair hygrometer conjointly, at several Russian stations, the former failing with their low temperatures. He had found the hair hygrometer work well.

Several speakers undertook to make comparative observations, the discussion became rather discursive, and no decision is reported.

**8A.** *In what way can uniformity in describing the directions of the wind be attained ?*

Sr. F. DA SILVEIRA (W.) 16 points, and the same letters or figures for each, should be universally adopted.

M. CARL FRITSCH (W.) 8 points, N, N.E, &c.

Dr. MOHN (W.) By the English letters, no numerals.

BORDEAUX MEETING (W.) 16 points.

The COMMITTEE (T.) That in order to remove the confusion arising from the opposite use of the letter O by the Latin and Teutonic races, the English lettering should be universally used.

Proposal accepted by the meeting.

**8B.** *Is the deduction of the mean direction of the wind by Lambert's formula desirable? Is it desirable or not to include very light winds (force 0) in constructing wind roses for the direction of the wind ?*

Sr. F. DA SILVEIRA (W.) At first-class stations Lambert's formula might be used if velocity was taken into account. Would not altogether reject very light winds.

M. CARL FRITSCH (W.) Yes. Light winds should not be ignored.

Capt. HOFFMEYER (W.) Lambert's formula not satisfactory ; force should be considered.

Dr. MOHN (W.) Lambert's formula should not be used, nor force 0 included.

Prof. RAGONA (W.) Lambert's formula useful in its original form.

Dr. WOLF (W.) Lambert's formula is valueless.



BORDEAUX MEETING (W.) Prefer wind roses, to Lambert's formula but are willing to give both if required. Slight winds are generally local, and should not be included.

The COMMITTEE (T.) Lambert's formula should not be used. Calms should be designated (C), and entered separately.

M. VON OETTINGEN spoke in favour of his new anemometer, which reduces the wind's direction and force to the four axes of a system of rectangular co-ordinates. The apparatus will be fully described in the next Dorpat report.

M. HANN, in an able speech, pointed out the weaknesses of Lambert's formula; and on a division, the proposals of the Committee were adopted by 12 to 7.

9. *What scale should be employed for the force of the wind when it is not determined by actual measurement, but only by estimation?*

Sr. F. DA SILVEIRA (W.) A numerical one, but the same in all countries. In Portugal we employ the scale 0—7.

M. CARL FRITSCH (W.) Scale of 0—10.

Capt. HOFFMEYER (W.) Scale of 0—6 is easiest to understand, but force 6 never occurs with us at Copenhagen.

Dr. MOHN (W.) Scale 0—6, being half the Beaufort. Recommends cheap and simple pressure anemometers as a check on estimations of force.

Prof. RAGONA (W.) Scale unsatisfactory, because each observer attaches a different value to the maximum unit, *e.g.*, on a scale of 0—7, 7 would stand for 60 miles per hour at a sheltered, and for 70 at an exposed, station.

BORDEAUX MEETING (W.) From a telegraphic point of view, the maximum should be expressed by a single figure, and should therefore not exceed 9. The actual scale is unimportant provided there be uniformity.

The COMMITTEE recommended 0—6.

M. JELINEK (T.) 0—10 best, harmonizing with metric notation, and being generally adopted.

M. VON STERNBACH defended scale 0—10 or 0—12.

M. VON OETTINGEN (T.) Precise values must be assigned to each unit.

Mr. SCOTT (T.) 0—6 insufficient; it was very difficult to assign equivalents to each unit of any scale.

M. BRUHNS (T.) 0—10 best; suggested adjournment of discussion, and that comparative experiments be made at several observatories of the actual velocity with estimated force.

M. WILD described experiments for determining value of each unit, and pointed out that the indication of anemometers depended on their position, a remark which was confirmed by M. von Freeden and Mr. Scott.

The MEETING decided on referring the question of comparison and the selection of a scale to Messrs. Buys Ballot, Jelinek and Scott.

10. *Is it desirable to introduce simple counting instruments for determining the velocity of the wind? What units should be taken for the discussion of the velocity of the wind?*

Sr. F. DA SILVEIRA (W.) Yes, and compared with the estimated scale value.

M. CARL FRITSCH (W.) Yes, and especially if estimation could be entirely abolished. Metres per second.

Capt. HOFFMEYER. (W.) The Danish Met. Inst. contemplate using a small pressure anemometer.

Dr. MOHN (W.) Yes, in open localities. Kilometres per hour.

BORDEAUX MEETING (W.) Yes; if the same unit cannot be at once everywhere employed, it should be in all publications of an international character.

The COMMITTEE recommended the use of the simplest form of Robinson's cup anemometer, and that the velocity be expressed in metres per second.

MR. SCOTT hoped experiments would shortly be made in England, to test the accuracy of the ratio of one to three, on which deductions from these instruments have hitherto been based.

The MEETING adopted the recommendation of the Committee.

11. *What is the best form, size, and mode of exposure of rain gauges. At what hour of the day should the fall be measured?*

Sr. F. DA SILVEIRA (W.) At Lisbon observatory we have a self-recording rain gauge, also one of Babinet's gauges. At the secondary stations Babinet's gauges only. We prefer 9 a.m.

M. CARL FRITSCH (W.) Those used by the Central Anstalt in Vienna are quite satisfactory; two should be supplied to each station, and care should be taken that no water can enter except through the funnel. Would prefer midnight as hour of observation, but it is too inconvenient, therefore recommends noon.

CAPT. HOFFMEYER (W.) An original, very simple and durable gauge has been constructed at Copenhagen, by Hr. Docent Fjord, after many years' careful experiments. It only costs 9s. complete.

Dr. MOHN (W.) Not heavy (? large), for the observers will not bring masses of snow indoors to melt.

Prof. RAGONA (W.) At Royal Observatory, Modena, amount is measured at midnight.

Mr. SYMONS sent copy of rules generally adopted by British observers of rainfall. Recommends circular funnels with strong rims; square funnels, and those not made strongly are more liable to distortion and to warp with the sun's heat. With respect to the size of the orifice, very elaborate experiments have been made under his direction, and the result is to show that the variation from this cause is not more than one or two per cent. In actual practice recommends gauges whose orifice is 5 in. in diameter for ordinary stations where observations are made daily, and 8 in. gauges for stations upon mountains and in

localities only visited monthly. He finds in England that 9 a.m. is by far the most usual and convenient, (and therefore punctually adhered to) time of observation.

**BORDEAUX MEETING (W.)** The simplest gauge, and that most used in France, is the one recommended by the Scientific Association, circular funnel about 9 in. diameter. At the central observatory it is sunk in the ground, in a very open space, so that the rim is about 4 in. above the soil, and surrounded by grass. At the normal schools Babinet's gauge is used, the funnel of which is some 6 ft. above the ground. In winter a lamp is placed inside which melts the snow as it falls. We include in the record of each month all that falls up to 7 or 8 a.m. of the first day of the next.

The COMMITTEE recommend that a committee be appointed to draw up a complete record of past experience for presentation to the next Congress. They recommend two hours of observation, one in the morning, and if possible one in the evening.

**Mr. BUCHAN (T.)** The first part of the subject had been almost exhausted, by experiments and observations, reported in Symons's *British Rainfall*, and in the *Meteorological Magazine*.

**M. GALLE** drew attention to the influence of elevation on the amount collected.

**M. BRUHNS (T.)** It should be recommended that all gauges should be identical, that the receivers should be circular, 14 in. diameter, and 8 ft. 2 in. above the ground. But that at central stations comparative observations of various gauges should be made.

**M. BUYS BALLOT** "supported the proposal [Query.—That of M. Bruhns, or that of the Committee. Ed.] and the meeting adopted it."

**M. BUYS BALLOT** would desire to reverse the recommendation of the committee on the second point, as, if measured in the evening, there could be no uncertainty as to the civil day on which the amount fell. Several members pointed out that the decision on this point must be governed by that on question 18, and it was agreed to leave it undecided.

## 12. *Should the days of rain and snow be counted separately or together?*

**Sr. F. DA SILVEIRA, Dr. Mohn, Mr. Symons, and the Bordeaux Meeting all (W.)** Yes, count them separately.

**M. CARL FRITSCH (W.)** Should not attempt to distinguish them; if it is attempted the days with any kind of downfall should be enumerated.

The COMMITTEE recommend that they be separately entered in three columns, headed respectively, rain, snow and mixed days (snow and rain).

**M. VON STERNBACH (T.)** This would greatly increase the duty of observers, as they must be constantly on the watch.

**M. WILD (T.)** It would not; it was impossible to obtain perfect

records, as observers could only in a general way report what fell at night.

The MEETING adopted the recommendation of the Committee.

13. *Is it desirable in giving the falls of hail to draw a distinction between "graupel" \* and true hail ?*

Sr. F. DA SILVEIRA (W.) If possible, but too many details must not be expected from second-class stations.

M. CARL FRITSCH (W.) Such separation is extremely difficult.

Mr. SYMONS (W.) Undesirable.

BORDEAUX MEETING (W.) Yes, because they indicate different atmospheric conditions.

The COMMITTEE recommended that it be carried out as far as possible in the interests of agriculture and practical life.

M. BRUHNS approved of the proposal of the Committee.

M. SOHNKE opposed ; it was an impossibility.

M. WILD said that according to the Russian instructions it was done ; hail was only given with thunderstorms.

M. PRESTEL (T.) it was quite possible.

No decision reported.

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We have much pleasure in announcing that M. Buys Ballot has published another pamphlet (in English), stating his views upon many of the points raised at the Conference, and being, in fact, a sequel to his "*Suggestions on a Uniform System of Meteorological Observations*," Utrecht, 1872.

As it is necessary to condense the remarks in these pages as much as possible, we have asked Dr. Ballot to send copies to our publishers, and shall, therefore, assume that those who are interested in the subject will provide themselves with copies. Had it been in Dr. Ballot's own language, we should not have adopted this course, but as he has been kind enough to use our language, it would be waste of space to reprint that which can be obtained at the price we have ourselves paid for the copies.

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### THUNDERSTORM AT STROUD.

*To the Editor of the Meteorological Magazine.*

SIR,—A slight thunderstorm passed over here at about 7 a.m. this morning, (Sunday), from the S.S.E., with four or five vivid forked flashes of lightning. It apparently spent itself in this neighbourhood. It lasted about half-an-hour. Rainfall .15 ; greatest heat, Saturday, March 29th, 60° ; greatest cold 40°.

R. E. STANTON.

*Upfeld, Stroud, March 30th.*

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\* Mr. Scott remarks, "There is no special term for 'graupel' in English ; it differs from hail, in that the stones are small pellets of snow, and are not coated with ice." We presume it is the "form of water" often referred to in these pages (in connection with a supposed periodicity of fall, on or about March 8th), as "soft hail," "hail balls," and "snow balls."

# SNOW-BALL SHOWER IN SUSSEX.

*To the Editor of the Meteorological Magazine.*

SIR,—A very remarkable snow-ball shower fell here yesterday afternoon, between 3.45 and 4 p.m.; the balls were about the size of ordinary marbles, but widely scattered, certainly more than two feet apart; they were very light, and broke into fragments upon the slightest touch. Two sharp flashes of lightning occurred, and very loud thunder. I observed these storms passing over the whole of the S.E. of England during the afternoon. Thunder in all directions.

C. L. PRINCE.

*Observatory, Crowboro' Beacon, April 7th.*

## "CLIMATE AS INDICATED BY NATURAL MEANS."

*To the Editor of the Meteorological Magazine.*

SIR,—After having lately been to no little trouble and expense in providing myself with a new set of Meteorological instruments of the most approved patterns, it is rather discouraging to be told by those competent to form a correct opinion on the subject, that any observations I may make with these instruments, will, for all practical purposes, be little short of worthless.

On the other hand, however, I am somewhat consoled by the following considerations—1. That the words of some at least of those who express these opinions are contradicted by their actions.—2. That they also remain unsupported by the practice of our leading Meteorologists.—3. That plants, insects, and birds have been in existence from time immemorial, while meteorological instruments of assured accuracy are but of yesterday; yet few will doubt which have done most towards advancing our knowledge of the Earth's atmosphere.—4. That at present no tangible system has been proposed, likely to prove equally trustworthy at all points.

I wish to think, and I cannot help thinking, this proposal to trust entirely to vegetable and animal life for our knowledge of climate, to be an unwise one; although, like most other fallacies, it is supported by a certain substratum of truth,—which substratum, as I understand it, is this, that a correct knowledge of what I may term the cumulative effect of a variety of influences, can only be obtained direct from Nature herself; although I do not myself see why much, even of this knowledge, should not reasonably be inferred from our ordinary observations with instruments.

This naturally brings me to what I can but consider the most important point of the subject, and that is *the cause* of this reactionary feeling against our present mode of observing the weather, in which hitherto we have placed the greatest confidence. This appears to me to be, the mechanical and unreasoning way in which meteorological registers are often used—the abuse, and not the intelligent use, of our instruments. The same may be said of averages of all kinds, against the employment of which there is now such a sudden outcry.

To desert our present system of observation would be very like

casting off tried armour for that which is untried,—like endeavouring to ascertain the value of an unknown quantity by means of one equally unknown.

Having thus succeeded in persuading myself that there is little to fear from this new proposal, I shall return to my new toys with reviving confidence; not forgetting, however, to supplement their indications, as I have hitherto done those of their predecessors, by some slight record of my own feelings, (Sir Humphry Davy's "body-ometer,") and occasional botanical and other notes. Trusting you will excuse the undue length of this communication,

I remain Sir, yours truly,

EDWARD MAWLEY.

*Addiscombe, February 22, 1873.*

[We are sorry to find that even a single observer should have attached to the letters which have appeared on this subject so much weight as Mr. Mawley *seems* to have done—if indeed his letter is not, as we rather suspect, a covert satire. At any rate, while, as stated on the cover of every copy of this Magazine, we decline all responsibility for the statements in the letters which it contains, we cannot refrain from saying that had we supposed that anyone would have drawn from the previous letters the inference implied by Mr. Mawley's, we should either have rejected them, or taken them as texts for a note shewing the impracticable and fallacious character of any such scheme.—ED.]

### THE FEBRUARY SNOW-STORMS.

*To the Editor of the Meteorological Magazine.*

SIR,—I am not sure that your correspondents' notes quite do justice to the severity of the snow storms of February much nearer the metropolis. That of the 2nd and 3rd of February was the severest I ever saw in the south of England. Early on the 2nd the wind reached a velocity of 33 miles an hour, from the E., and on the 3rd one of 35 miles an hour from N. was registered. Drifted by these high winds the snow completely blocked up our country lanes, some not being open for traffic for several weeks. The best measurements I could obtain in a sheltered position, by inverting the gauge funnel, was 0·66 in., the depth on the level being about 6 in. But every particle blew out of most exposed gauges, only those with high rims being able to retain it. Drifts, 4 to 6 ft. deep, were to be found behind every hedge, and here and there the depth reached 8 ft. or 10 ft. Some traces of the snow still remained in the middle of March.

The snow of the 23rd February was not accompanied by wind; it was principally remarkable for the rapidity and thickness of the fall. In about 8 hours it had attained a depth of 8 in. The temperature being only 27°, it was excessively dry and light. It 'balled' on the feet and made walking difficult and even dangerous. It gauged only 0·43 in.

The mean of the daily maxima and minima in February was 33°·3, and that of the 9 a.m. and 9 p.m. observations 33°·2. Not one night

was clear throughout, and there was very little sun. Consequently the daily range was very small, only  $8^{\circ}6$ ; and at my anemometer station (416 ft.), 65 ft. higher than this, as small as  $7^{\circ}$  at 4 ft., and  $6^{\circ}8$  at 18 ft., the means of maxima and minima in these positions being  $33^{\circ}8$  and  $33^{\circ}6$  respectively. Frost occurred every night but two, but it frequently thawed during the day. The frost was continuous from January 27th to February 4th, and nearly so from January 25th to February 14th, when the ice was 2 inches thick, but very rotten.

What a contrast is the present weather! Cloudless day and night, (though sometimes foggy in the morning), range  $30^{\circ}$ , minima  $29^{\circ}$  to  $32^{\circ}$ , and maxima  $59^{\circ}$  to  $61^{\circ}$ .

F. W. STOW.

*Harpden, March 29, 1873.*

### TYPHOON AND RAINFALL IN JAPAN.

[WE have been favoured by Mr. H. St. John Joyner with the following extract from a letter from Mr. H. B. Joyner, C.E., of Yedo, Japan, who has also obliged us with the annexed table of rainfall from a gauge presented by ourselves.—ED.]

“During the past year there has been nothing peculiar in the weather. You will see, by the rainfall return, that we had rain throughout October, November, and December, which is not generally the case, especially in November and December; those months usually are like May and June at home. We only had one real typhoon, and that was very slight (comparatively); it was on 10th October, with 4.73 rain. There was very little damage done as compared with the year before. The barometer readings were as follows, but were only taken with a small pocket aneroid—

October 10th, 9.0	a.m.	...	29.83		
1.0	p.m.	...	.45		
2.0	„	...	.40		
3.10	„	...	.35		
3.20	„	...	.31		
4.0	„	...	.25		
4.20	„	...	.20		
4.55	„	...	.15	Wind	E.S.E.
5.10	„	...	.10	„	„
5.25	„	...	.05	„	„
5.50	„	...	29.00	„	S.E.
6.20	„	...	28.90	„	„
6.40	„	...	.80		
7.0	„	...	.65		
7.30	„	...	.40		
7.45	„	...	28.25	No Wind	
8.30	„	...	..	„	„
8.45	„	...	28.50	N.E.	
9.20	„	...	.70	„	
9.40	„	...	.75	„	
10.0	„	...	28.90	„	

When the *lull* came at 7.45 p.m., I put on my waterproof (not that it rained, but I knew it would begin again as suddenly as it had left off),

and went on to the railway embankment to see what mischief the first part of the typhoon had done to it—it runs through part of the bay just below our house. The damage was but slight,—the ballast washed away in many parts, and some small portions of the bank ; it had taken the fronts off about eighteen little Japanese houses, facing the sea, and many pieces of junks were being washed ashore. I lost no time, but hurried back with my lamp, before the wind rose again. I saw hardly any one except some wreckers looking out for anything they could find.”

*Register of Rainfall in 1872 at Cho-ji, Takanawa, Yedo, by  
Henry B. Joyner.*

Latitude, 35° 43' N. Longitude, 139° 43' E. Time of Observation, 7.30 a.m.  
Diameter of gauge, 5 inches.  
Height above ground, 4 in. ; above sea level, 50 ft.

Date.	Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1...	...	...	...	·84	·06	...	·16	...	·13	...	·03	...
2...	...	...	...	...	...	...	...	...	·05	·11	·53	·07
3...	...	...	...	...	·10	...	...	...	1·68	·05	·83	·19
4...	...	...	S ·48	...	·30	...	...	·52	·04	...	...	·08
5...	...	S ·11	...	...	...	...	...	·04	...	·08	...	...
6...	...	...	...	...	...	·10	·40	·01	...	·25	·06	2·20
7...	...	...	·10	·30	...	...	...	...	...	...	...	...
8...	...	...	...	...	...	...	...	·39	...	·30	...	·32
9...	...	...	...	...	...	·68	...	...	...	1·37	...	...
10...	...	...	...	...	...	·26	·01	...	·48	4·73	·13	...
11...	...	...	·23	·26	...	·72	...	·38	·57	...	1·22	...
12...	...	...	...	...	·17	·82	·06	·12	·13	...	·17	...
13...	...	...	...	·03	·03	·01	...	...	·02	1·12	...	...
14...	S ·50	...	·58	·02	...	...	...	...	...	...	...	...
15...	...	...	...	·76	...	...	·01	·03	...	...	·67	...
16...	...	...	...	·56	·72	·52	...	...	...	...	...	...
17...	S ·19	...	...	...	...	·20	·C1	...	...	...	...	S ·60
18...	...	...	·55	...	...	...	...	...	...	...	...	...
19...	...	...	·09	...	...	...	...	...	·45	...	...	...
20...	...	...	...	...	...	...	1·21	...	...	1·30	...	...
21...	...	...	...	...	·01	...	·30	...	...	...	...	...
22...	...	...	·72	...	...	...	·25	1·90	...	·05	3·01	...
23...	...	...	...	·25	...	·80	·12	...	...	...	·04	...
24...	...	...	...	1·12	...	·48	...	·42	...	...	...	...
25...	...	...	...	·52	·18	·28	...	3·14	·79	·73	...	...
26...	...	·15	...	3·30	...	·75	...	...	·55	·39	...	...
27...	...	·06	...	·34	...	·01	...	·01	·03	...	...	...
28...	...	...	...	...	...	...	...	·03	...	...	·18	·27
29...	...	...	·35	·27	1·12	·53	...	·01	...	·19	2·03	...
30...	...	...	...	...	·01	·37	...	·01	·60	·01	·01	...
31..	...	...	...	...	...	...	...	...	...	...	...	...
Totals	S ·69	·32	3·10	8·57	2·70	6·53	2·53	7·01	5·52	10·68	8·91	3·73

Total from January 1st to December 31st, 60·29 in.

H. B. JOYNER, C.E.



## THE METEOROLOGICAL COMMITTEE AND THE SCOTTISH METEOROLOGICAL SOCIETY.

IN common, doubtless, with many of our readers, we have received a copy of certain correspondence respecting the difference which has arisen between the above bodies, whom it will be remembered Prof. Piazzi Smyth recently amusingly described as the "the richly endowed office in London," and "a poor voluntary society in the Provinces." The subject has also been brought prominently forward by leading articles in the principal Scotch newspapers, and in other ways, and we are, therefore, reluctantly obliged to refer to it. Our unwillingness arises from a conviction of the truth of the many proverbs, as to what should and should not be done in public; and the consciousness that these pages will carry throughout Europe, and across the Atlantic the information that two bodies who ought to be working in the closest harmony are in strong opposition. The documents having been laid before the Board of Trade, we regard the public discussion of the subject as premature, and we therefore enter into no details, and confine ourselves to expressing the hope that for the credit of one of the parties, of their countrymen, and of science itself, the present antagonism will be removed before our next issue.

### CYCLONES AND ANTI-CYCLONES.

*To the Editor of the Meteorological Magazine.*

SIR,—Ill-chosen terms have much to answer for in propagating and perpetuating error, and it is on this ground alone, and not in a spirit of hyper-criticism that I would ask meteorologists to reconsider the propriety of the term "anti-cyclone" now coming into general use.

The facts of the case I take to be these. An isobaric chart of the atmosphere—at least in temperate latitudes—for any given moment of time would exhibit a number of systems of irregularly concentric rings, some of which systems would represent areas of elevation and others areas of depression. And if the way of the wind were denoted by arrows, it would be found that while the general movement of the air about the centres of depression was rotary in a certain direction, the movement about the centres of elevation was (although less distinctly) rotary in the opposite direction. Hence the centres and areas of depression, with their accompanying winds, having been called cyclones, the centres and areas of elevation, with their accompanying winds, have come to be called anti-cyclones.

Now to the term "cyclone" I do not know that any valid objection can be raised, although in extending the application of this word to all barometric depressions, whether attended with strong winds or not, it ought to be remembered that its original use was limited to such depressions as were accompanied by hurricanes.

The case is different with the term "anti-cyclone." Certainly, it may be alleged that nothing more is intended by this expression than that the movement of air about a centre of elevation is of an opposite kind

to that which prevails about a centre of depression. But something more than this *seems* to be meant, and a student of meteorology, justly impressed with the idea of a causal relation between each centre of depression and the rotation of the winds about it, would naturally conclude from the terms employed that a similar causal relation obtained between each centre of elevation and the rotation of the winds about it.

Yet this I believe would be an error. Let the reader draw or imagine a circle representing an area of barometric elevation, and let him surround this with any number of other circles touching it circumferentially, these latter representing each an area of depression. Then let him insert in each depression-circle, at its point of contact with the elevation-circle, an arrow indicating the retrograde rotation of the wind about the centre of depression, and he will find that he has at the same time represented the direct rotation of the wind about the centre of elevation. Now, as every area of elevation must in nature, no less than in the diagram suggested, be surrounded by areas of depression, it seems to follow that the direct circulation of the air about a centre of elevation is only a varied aspect of its retrograde circulation about a centre of depression, and the term "anti-cyclone" is misleading as appearing to imply a relation which does not exist.

GEORGE F. BURDER, M.D.

*Clifton, 1st March, 1873.*

## INCREASE OF WINTER TEMPERATURE.

*To the Editor of the Meteorological Magazine.*

SIR,—I should much like, with your permission, to call the attention of your readers to a circumstance of great scientific and practical interest, viz., the increasing mildness of our winters. The following are the average winter temperatures, taking the months of December, January, and February as the winter, for each decennial period for the last century, compiled from Mr. Glaisher's tables.

			Deg.				Deg.
1772-81	...	...	37.0		1822-31	...	37.8
1782-91	...	...	36.6		1832-41	...	38.3
1792-1801	...	...	36.9		1842-51	...	39.3
1802-11	...	...	38.1		1852-61	...	38.7
1812-21	...	...	37.3		1862-71	...	39.7

Taking periods of twenty-five years, the averages were—

			Deg.				Deg.
1772-96	...	...	37.0		1822-46	...	38.3
1797-1821	...	...	37.4		1847-71	...	39.3

It thus appears that with certain temporary fluctuations our winter temperature has gone on steadily increasing for the last seventy or eighty years, and would seem to be still proceeding at an accelerated rate. It is remarkable, too, how the standard of the coldest winters to

which we seem to be liable is rising. Formerly we had winters averaging only 32 deg, but since 1814 there has been no winter under 33, since 1830 none under 34, since 1847 none under 35, and since 1855 none under 36.

Now the question is, whether this change is to be regarded as permanent or temporary, and to answer this, can any light be thrown on the character of the winters during the century preceding 1770?

If it can be shown that during this period we had a long run, say 30 to 50 years, of winters of equal mildness to our present ones, we may then, I presume, expect a recurrence of the rigorous period 1770—1800; but if, as I myself believe, no such a run of winters as we have had since 1847 was ever known to our ancestors, then we must refer the change to some permanent cause, and must expect it still to continue. My own theory on the subject is, that the enormous increase of coals and gas burnt in factories, steam engines, streets and private houses, has a certain effect in raising the temperature of the whole air, and the great development of this seems to coincide with the increased mildness of the winters. There would seem to have been no particular change in our climate until about the year 1800, since when it has been steadily rising, and more especially the last thirty years. The summer temperatures have risen only slightly, and this I think might be expected, as there is not only much less gas and coal burnt, in the summer, but it would naturally have much less effect to increase the heats of summer than to mitigate the cold of winter.

Hoping that some of your readers may throw more light on this subject,—I am, Sir, yours faithfully,

F. TAYLOR.

19, Canonbury Park Square, N., February 23rd, 1873.

#### •BOOKS RECEIVED.

*Reduction of the Meteorological Observations, made at the Royal Horticultural Gardens, Chiswick, in the years 1826-1869.* By JAMES GLAISHER, F.R.S., London: Spottiswoode & Co. 8vo.

*On the Agricultural Geology of the Weald.* By W. TOPLEY, F.G.S. [Extract from Journal Roy. Agricultural Soc.] 8vo.

*Rainfall at Torquay during eight years ending Dec. 31, 1871.* By W. PENGELLY, F.R.S. [Ext. from Trans. Devonshire Association.] 8vo.

*Rainfall in Devonshire in 1871, and in six years ending Dec. 31, 1871.* By W. PENGELLY, F.R.S. [Ext. from Trans. Devonshire Ass.] 8vo.

*Tyneside Meteorological Report, 1871.* Edited by Rev. R. F. WHEELER and Rev. Dr. HOOPPELL. [Ext. from Natural Hist. Trans. of Northumberland and Durham.] 8vo.

*Seven years Meteorology of Sidmouth.* By J. I. MACKENZIE, M.B., Cantab, &c. [Ext. from Trans. Devonshire Association.] 8vo.

*Address to Meeting of South Wales Branch of Brit. Med. Assoc., held July 1872, at Merthyr Tydfil.* By T. J. DYKE, F.R.C.S. Eng., President. Merthyr: Farrant and Frost. 8vo.

*Determination of heights by the thermo-barometer.* By F. F. TUCKETT. [Ext. from the Alpine Journal.] 8vo.

*Femaarsberetning fra det Kongelige Landhusholdningsfelfkabs Meteorologiske Comitee for 1866-1870.* Bed Poul la Cour.

*Quarterly Weather Report, Jan. to Mar. 1872.* London: Stanford. 4to.

MARCH, 1873.

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 41 or more fell.	Max.		Min.				
				Dpth.	Date.		Deg.	Date.	Deg.	Date.			
I.	Camden Town .....	1.46	— .62	.24	9	17	63.7	27	29.2	14	4	8	
II.	Maidstone (Linton Park) .....	1.66	— .83	.42	31	15	74.0	30	26.0	13	9	...	
III.	Selborne (The Wakes) .....	2.95	+ .35	.51	9	18	64.0	30	27.1	22	11	16	
IV.	Hitchin .....	1.52	— .65	.25	6	18.	60.0	30	23.0	13	17	...	
V.	Banbury .....	2.22	+ .02	.51	16	18	61.0	30	25.5	13	12	...	
VI.	Bury St. Edmunds (Culford) .....	1.66	— .54	.21	20	15.	60.0	30	24.0	13	18	24	
VII.	Bridport .....	3.04	+ .17	.87	16	14	63.0	27	26.0	13	5	...	
VIII.	Barnstaple .....	3.77	+ .62	.48	1	17	67.0	28	28.5	25	...	...	
IX.	Bodmin .....	4.47	+ .72	.57	4	18	64.0	25*	29.0	13	2	6	
X.	Cirencester .....	3.06	+ .46	.93	16	15	...	...	...	...	...	...	
XI.	Shiffnal (Haughton Hall) .....	3.20	+ 1.26	.86	16	17	56.0	30	22.0	13	14	...	
XII.	Tenbury (Orleton) .....	3.38	+ .96	.92	16	17	60.5	28	23.0	13	9	21	
XIII.	Leicester (Wigston) .....	2.07	— .04	.33	16	14.	65.0	28	25.0	12	...	...	
XIV.	Boston .....	1.50	— .29	.41	11	15	59.0	30	28.0	14	9	...	
XV.	Grimsby (Killingholme) .....	1.84	— .55	.11	20	20	54.0	4	28.0	13†	5	...	
XVI.	Derby .....	2.15	— .09	.71	16	15	61.0	30	27.0	13	8	...	
XVII.	Manchester .....	1.79	— .90	.35	9	16.	66.3	28	...	...	...	...	
XVIII.	York .....	2.16	+ .17	.47	7	15.	57.0	28	27.5	13	10	...	
XIX.	Skipton (Arncliffe) .....	3.85	— .96	1.00	7	15	...	...	...	...	...	...	
XX.	North Shields .....	1.86	— .49	.39	16	24.	51.0	4	27.5	13	5	9	
XXI.	Borrowdale (Seathwaite) .....	7.30	— 6.10	3.52	5	12.	...	...	...	...	...	...	
XXII.	Cardiff (Ely) .....	4.46	+ 1.51	.60	6	17	...	...	...	...	...	...	
XXIII.	Haverfordwest .....	4.17	+ .72	...	...	...	60.0	27	26.0	12	6	...	
XXIV.	Rhayader (Cefnfaes) .....	3.30	— .54	.85	10	8.	62.0	...	23.0	...	...	...	
XXV.	Llandudno .....	2.09	— .17	.42	16	12.	68.7	26	30.6	14	3	...	
XXVI.	Dumfries .....	3.12	+ .14	.84	6	15.	65.0	27	25.0	1	10	17	
XXVII.	Hawick (Silverbut Hall) .....	1.61	...	.41	6	18.	...	...	...	...	...	...	
XXVIII.	Kilmarnock (Annanhill) .....	2.08	...	.36	25	17.	63.0	29	27.0	1	7	...	
XXIX.	Castle Toward .....	1.79	— 2.08	.43	9	10.	58.5	28	...	...	...	...	
XXX.	Leven (Nookton) .....	1.70	— .37	.41	6	19	54.0	4	29.0	6	10	23	
XXXI.	Stirling (Deanston) .....	1.45	— 2.08	.40	11	13	60.0	27	24.7	20	14	19	
XXXII.	Logierait .....	1.98	...	.39	3, 9	14	54.0	27	21.0	20	17	...	
XXXIII.	Braemar .....	.69	— 1.52	.30	14	7.	55.0	30	27.6	7	10	29	
XXXIV.	Aberdeen .....	2.57	...	.87	7	22	50.1	4	27.2	1	3	19	
XXXV.	Inverness (Culloden) .....	...	...	...	...	...	...	...	...	...	...	...	
XXXVI.	Portree .....	3.91	— 5.13	.75	10	16	...	...	...	...	...	...	
XXXVII.	Loch Broom .....	1.43	...	.36	12	14	...	...	...	...	...	...	
XXXVIII.	Helmsdale .....	2.11	...	.55	10	15	...	...	...	...	...	...	
XXXIX.	Sandwick .....	2.20	— .13	.40	8	12	48.1	27	29.9	1	4	17	
XL.	Caherciveen Darrynane Abbey .....	4.65	...	.53	27	19	...	...	...	...	...	...	
XLI.	Cork .....	4.85	...	1.46	1	15	...	...	...	...	...	...	
XLII.	Waterford .....	3.87	+ .98	1.00	30	17	59.0	3	30.0	1, 13	3	...	
XLIII.	Killaloe .....	3.98	— .34	.74	30	17	67.0	26	27.0	13	5	16	
XLIV.	Portlington .....	3.24	— .07	.51	31	26	59.0	27	27.5	13	8	...	
XLV.	Monkstown .....	2.54	— .04	.54	6	15	...	...	...	...	...	...	
XLVI.	Galway .....	3.13	...	.55	8	17.	64.0	26	31.0	14†	3	...	
XLVII.	Bunninadden (Doo Castle) .....	2.83	...	...	...	...	...	...	...	...	...	...	
XLVIII.	Waringstown .....	2.37	...	.42	1	17.	62.0	29	28.0	19	10	20	
XLIX.	Edenfell (Omagh) .....	2.01	...	.32	9	18	61.0	29	28.0	12	13	...	

\*And 26. †And 14. ‡And 15.

+ 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.—Mostly dull, but not severe up to the 22nd, when a week of very fine bright, sunny weather, followed with T and L on 29th and 30th, and R on 31st, the most wintry day being the 21st, S and sleet falling on the 1st and 16th; dense fog on 18th, 27th, and 29th; winds mostly N. and E., but never very high; dust flying on the roads on 15th, 25th, 26th, and up to the 30th, but the early part of the month was dull and dirty.

SELBORNE.—Remarkable storm of H, R and S, with fog at 8.30 a.m. on 1st, S in very large flakes; violent wind and H at 10 p.m. on 9th, tempestuous night; fog on 15 days; prevailing winds W. and S.W. during first week, from 18th to 24th N.E.; a very bleak yet wet month till near its close, then warm and genial; all garden work in abeyance till near the end.

BANBURY.—S on 1st, 10th, 13th and 14th; R .02 only different from the average.

CULFORD.—Cold and sunless up to 24th, with foggy mornings, and days of bright sunshine from that day to end, including the 29th; thermometer in shade rose for the first time this year to 60° on 30th; S fell to a considerable extent on 1st; T on 10th, accompanied by H, S and R; H also fell on 11th, and S on 12th and 13th, H on the 19th, and S on 20th and 21st; westerly winds during 15 days, and easterly winds during 16 days; mean temperature of the month 41°.

BRIDPORT.—Fine month on the whole; heavy floods on the 1st from the melting of the S; south-westerly gale on 10th, easterly gale on 15th.

BODMIN.—Mean temperature of the month 46·1; rainfall .90 above the average of 24 years.

HAUGHTON HALL, SHIFNAL.—The month came in with R, sleet and mist, which continued almost daily to the 16th, when a fall of .86 brought it to a climax, from that day there was a cessation (except *slight* falls on 21st, 22nd and 23rd), till 30th, when .38 fell; the wind varied from N.W. to S.W. to 14th, when it became easterly, varying from N.E. to S.E. to the close; with fog on most mornings from 23rd; severe frost on 13th, temp. 22°; the month although cold went out "like a lamb." Stock dove first heard on 2nd; rooks building on 5th; peewits pairing on 24th; cushat first coos 26th; chaff first heard on 27th; yellow crocus began to open on 4th, and was full out and filled with bees on 25th; celandine flowers on 26th, and hawthorn begins to swell on 28th.

ORLETON.—The weather continued cloudy, cold and gloomy, with frequent falls of R and S and very little sun till 25th, when it became fine, dry and sunny to 30th; on 16th a large fall of S mixed with R occurred, which covered the valleys about 3 in. deep, and the hills 6 or 7 in.; to the east of us there was not any S, but steady R, 15 miles distant; the wind was frequently very rough and cold; temperature about 1°·2 below the average of the month; chaff first seen on 31st.

WIGSTON.—The weather during the last 10 days has been beautiful and dry; vegetation and agricultural work backward.

BOSTON.—Dull and cold to 11th, on which there was H, R, S, T and L, and sunshine; sharp frost on 12th; bitterly cold on 16th; stormy and cold, with S and R on 21st, thence to the end fine.

KILLINGHOLME, GRIMSBY.—The old saw proved, true as it did in 1868, about the month "coming in like a lion, and going out like a lamb;" several fogs: will the other saw be verified? "as many fogs as in March you see, so many frosts in May will be;" no high winds; vegetation very backward, and the ground very wet; rooks building on 2nd; frogs beginning to spawn on 25th, unusually late; apricot beginning to blossom on 8th; peach on 12th; yews shedding pollen on 29th.

NORTH SHIELDS.—S on 1st, 10th, 12th, 13th, 14th, 15th and 16th; lunar halos on 8th, 9th and 13th; frequent fogs, though weather was fine towards the end of the month.

SEATHWAITE.—Three inches and a half of R fell on 5th, and yet the total of the month was 6 in. below the average for March.

#### W A L E S.

HAVERFORDWEST.—The weather has been generally cold, with many falls of S heavy gales in the beginning of the month, but very mild and calm towards the end.

CEFNFAES.—The month has been dry and cold; much S and frequent N.E. winds; great mortality among the sheep and lambs.

LLANDUDNO.—A fine month, particularly the latter part, though the S was on the distant hills from the 1st to 31st; foggy till 3.40 p.m. on 14th, and a sudden darkness ending in a S shower; beautiful lunar halo on 10th; last week fine, but with fogs over the hills.

#### S C O T L A N D.

DUMFRIES.—During the first half of the month the weather was variable and inclement; the third week dry but ungenial, with very cold N.E. winds; the latter part of the month mild and very fine; the seed-time being most favourable; S fell on seven days; rainfall very slightly above the average; mean temperature  $41^{\circ} \cdot 4$  or  $2^{\circ}$  below the mean for March.

SILVERBUT HALL, HAWICK.—A month of cold, unhealthy, easterly winds, except during between 22nd and 28th, when it changed to W., changing again to E. on the latter day.

ANNANHILL.—Winds principally E. or its compounds, the force but light; ozone fairly developed, the highest test colour being during southerly wind; winter sown wheat has suffered from alternate frost and sunshine; oats were well got in, the seed-time being favourable; vegetation is now advancing rapidly, several of the forest trees being well in bud; S fell on three days, but did not lie.

CASTLE TOWARD.—A mild and fine month for out-of-door labour, having a few frosty mornings followed by sunshine; this month being favourable for farmers, they have taken full advantage of it; a good breadth of spring wheat having been got in, and lea ploughing is all but finished; potato planting for the Glasgow market farmers got in large fields in good order; sowing oats going on rapidly; in this locality vegetation advancing rapidly; gooseberries in flower, as well as pears and apples all in full bloom, (earlier here than in the south.)

DEANSTON.—First half of the month cold, with occasional showers of S and sleet; N. and N.E. winds prevailing; the latter half more genial, and very favourable for operating on the soil, and getting in the seed of all sorts.

ABERDEEN.—A month of dull, ungenial weather, with low temperature during the day, and comparatively high during the night; rainfall very little above the average; winds generally light, those from S.E. and S. being most prevalent; fogs daily from 24th to 31st (inclusive).

PORTREE.—A much drier month than usual for March, but much more frost.

LOCHBROOM.—This has been a glorious month for agriculturists, the land has been in splendid condition for cultivation, and the sowing of seeds and field labour, in consequence, is in an unusually advanced state; the latter half of the month passed without a drop of R falling, and the total for the month is the smallest but one since I began to observe; R is even prayed for now.

SANDWICK.—From 1st to 13th wet; the S of the previous month was thawed by the 3rd, sprinklings of S fell on 12th and 13th, which quickly thawed; after the 13th it was fine and dry only  $\frac{4}{100}$ ths of an inch having fallen during that time, so the soil is dry, and spring work progressing; there was a gale of about 50 miles an hour on the morning of the 12th; an aurora on three nights.

#### I R E L A N D.

MONKSTOWN.—A cold, dull month, with N. and E. winds.

DOO CASTLE.—Fine month, two-thirds of it free from R; farming operations not so forward notwithstanding as we could wish; ground cold, and but little vegetation.

EDENFELL, OMAGH.—Beginning of month generally raw and unsettled, but from 12th to the end (with the exception of two or three days), highly favourable for farming operations, which (notwithstanding the unfavourable winter), are now fully as forward as usual at this period.

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

LXXXVIII.]

MAY, 1873.

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## THE LEIPZIG CONFERENCE.

(Continued from page 42.)

14. *In counting thunderstorms, should the storms as such, or the days of storm be given? In what way should the instances of sheet lightning be noticed?*

SR. F. DA SILVEIRA (W).—Record separately number of storms and of days. Heat lightning always noted in our records.

M. CARL FRITSCH (W).—Impossible to individualize a storm, and therefore to count them; one might nearly as well try to count the gusts of wind. It is just as difficult to separate days of storm and days of sheet lightning, which in an overwhelming majority of cases is simply a distant storm.

DR. MOHN (W).—Have tried both methods. Perhaps enough to count days. Sheet lightning separately.

MR. SYMONS (W).—Count days of storm, but heat lightning being really a distant storm, is hardly entitled to be included.

THE BORDEAUX MEETING (W).—Both should be done. Regular observations in France prove that thunder is not heard more than 5 or 6 leagues, or lightning seen more than 30.\* Heat lightning being generally a sign of a distant storm, should be recorded, and also its azimuth.

THE COMMITTEE recommended only days of storm to be counted. Sheet lightning to be entered when independent.

No discussion or decision reported.

15. *What apparatus is to be recommended for the measurement of evaporation? What is the most suitable exposure for the vaporimeter?*

SR. F. DA SILVEIRA (W).—Whatever is adopted must be universally so. Should be exposed to rain, sun, &c.

\* Probably these are the leagues of the old system (=2000 toises) and represent respectively 12 to 15, and 74 English miles.

M. CARL FRITSCH (W).—A vessel similar to a rain gauge, but shallower, exposed to sun and rain, but guarded against undue heating.

Captain HOFFMEYER (W).—Attention must be paid to the temperature of the vaporimeter. Rational experiments on the subject are in progress at Copenhagen.

Prof. RAGONA (W).—Recommends for general use the vaporimeter by Tecnomasio Italiano of Milan, and where cost is no object, the self-recording one designed by himself.

Mr. SYMONS (W).—Very elaborate experiments are in progress at the expense of the Royal Society, and under the superintendence of Mr. Field. Forwarded description of the apparatus employed.

The BORDEAUX MEETING (W).—Think Piche's hygrometer gives the most comparable results.

The COMMITTEE considered the subject required further investigation, and recommended that a committee be appointed to report.

M. PRESTEL recommended his vaporimeter, which is described in Vol. I. p. 193, of the *Zeitschrift*.

M. EBERMAYER (T).—Lamont's should be recommended; he had found it work well.

M. NEUMAYER (T).—It was not desirable to enter into instrumental details. He would communicate the results of his Australian experience to the Committee, and he hoped others would do likewise.

No Committee reported to have been nominated; no decision arrived at.

16. *In what way should the proportion of cloud in the sky be estimated and indicated? Is it desirable to introduce for clouds, hydrometeors, and other extraordinary phenomena, a nomenclature which shall be independent of local language, and therefore universally intelligible?*

Sr. F. DA SILVEIRA (W).—Clear sky = 10, overcast = 0; but uniformity is the essential point. The introduction of universal symbols is very desirable.

M. CARL FRITSCH (W).—During the prevalence of thin cirrus, and the breaking up of ground fog, there is difficulty in determining the true amount of cloud. Thinks the introduction of general symbols desirable.

Dr. MOHN (W). Blue sky 0, overcast 10. Symbols very convenient.

Mr. SYMONS (W).—By all means introduce such symbols if possible.

The BORDEAUX MEETING (W).—The adoption of tenths of clear or cloudy sky will involve the disadvantage of two figures for telegraphy instead of one. Approve use of symbols.

The COMMITTEE recommend 0 = clear sky, 10 = overcast; that symbols be used, and a collection of all those at present in use be submitted for selection at the next Congress.

No discussion or decision reported.



17. *Should other Meteorological Elements than those already enumerated, e.g., Atmospheric Electricity, &c., be included in the scope of normal observations, and what are the best instruments for observing them?*

Sr. F. DA SILVEIRA (W).—Doubtless in first-class stations. A good electrograph would be a great acquisition.

M. CARL FRITSCH (W).—Freedom of choice should be given to every observer.

Capt. HOFFMEYER (W).—The observation of the motion of cirri is very important.

Dr. MOHN (W).—The so-called atmospheric electricity belongs as yet to physics.

Prof. RAGONA (W).—Observation of atmospheric electricity is very desirable.

The BORDEAUX MEETING (W).—There should be no limit as to extra subjects.

The COMMITTEE (T).—The subject should be referred to a committee.

Dr. PRESTEL (T).—Ozonometry should receive attention.

M. EBERMAYER (T).—The level of water in the soil should be observed, and also the "introduction of rain water into the soil by means of the Lysometer."\*

The lateness of the hour prevented thorough discussion of the foregoing questions (13 to 17) and they were referred to a committee consisting of MM. Ebermayer, Schoder, and Sohnke for report in 1873.

18. *Can uniform times of observation be introduced for the normal observations?*

Sr. F. DA SILVEIRA (W).—Very desirable, but not easily obtained with an unpaid staff. The duties at secondary stations should be amalgamated with those of schools, telegraphs, lighthouses, &c., so as to secure sufficient control.

M. CARL FRITSCH (W).—Fears that the introduction of uniform hours would lead to a diminution in the number of observers.

Dr. MOHN (W).—Time of observation must be adapted to suit observer.

Prof. RAGONA (W).—Impossible to secure uniformity.

Dr. WOLF (W).—Scarcely possible, e.g., if our Swiss hours 7, 1, 9, were changed to 6, 2, 10, we should probably lose the majority of our mountain stations.

The BORDEAUX MEETING (W).—Very desirable; if not practicable to the fullest extent, there should be some hours common to all systems.

The discussion on this subject was quite conversational, several speakers rising four or more times, as the question gradually split up into various branches not strictly included in the programme.

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\* Probably the word "Eindringen" would be more appropriately rendered "penetration" than "introduction," inasmuch as the Lysimeter is merely a continental form of Dr. Dalton's percolating gauge."

M. BRUHNS (T).—The hours should be optional, and the observations reduced to true means at the central station of each country. He would not accept returns from stations where less than two equidistant daily observations were made. For tri-daily observations, the hours of 6, 2, and 10 were best.

MM. JELINEK and VON OETTINGEN (T).—Single daily observations should not be rejected, but only those from tri-daily series should be published.

Mr. SCOTT (T).—Agreement as to hours could not be attained.

M. BUYS BALLOT concurred. He recommended 6, 2, 10. Wished to know if observations were to be taken according to local time, or simultaneously; he thought the latter desirable for barometric purposes.

M. VON OETTINGEN concurred and proposed that some of the central stations should observe according to astronomical time, *i.e.*, simultaneously.

MM. BRUHNS & JELINEK (T).—The required information might be obtained from the self-recording instruments.

Mr. SCOTT pointed out that hourly mean values were insufficient.

M. VON OETTINGEN had chosen the hours 1, 4, 7, 10, &c., because they were more rarely used; he wished to know if, where 3-hourly observations were taken, it was necessary that there should be uniformity of hours.

M. WILD (T).—That agreement on simultaneous hours brought with it the hateful question of the first Meridian.

M. VON FREEDEN (T).—That as the even hours were used at sea, it would be well to use them on land also.

M. BUYS BALLOT (T.), the selection of hours immaterial, provided they were capable of yielding by combination true mean values. He objected to systems (such as the Italian) which gave excessive weights to day observations.

M. VON FREEDEN preferred even hours, with 0h. as commencement.

M. JELINEK said that as regarded mean values the point was not important, but it was so with reference to individual observations.

M. VON OETTINGEN wished to know if the day should begin at noon or midnight. MM. BRUHNS and WILD adopted 1 a.m. Again, how should wind velocities which were totals be grouped?

Mr. SCOTT said that the Meteorological Committee made the day begin with noon, and took the total wind between  $23\frac{1}{2}$  and  $0\frac{1}{2} = 0$ , between  $0\frac{1}{2}$  and  $1\frac{1}{2} = 1$ , &c.

M. VON FREEDEN said at sea they always reckoned from 0h. to 0h.

M. BUYS BALLOT (T.) observations on the same day could not be separated.

M. BRUHNS (T.) as opinions were so divided, the question had better be postponed till 1873.

19. *Can rules universally applicable be laid down for the Verification of Instruments and the Inspection of Meteorological stations?*

SR. F. DA SILVEIRA (W.) Certainly.

M. CARL FRITSCH (W.) Yes; it is part of the duty of the Central Bureaux.

DR. MOHN (W.) With difficulty.

The BORDEAUX MEETING (W.) Yes, it would be most advantageous.

M. WILD (T.) Each station should be inspected every 5, or at least every 10 years.

M. BRUHNS said he had obtained funds for an annual inspection, but soon found such frequency unnecessary.

MR. BUCHAN (T.) there should be biennial inspection, not so much with regard to the instruments as to the personal contact of the observer with a competent inspector.

MR. SCOTT found it unnecessary to take testing apparatus with him; their stations were supplied with duplicate instruments, and if they agreed it was assumed that no change had taken place.

M. BRUHNS always took standard instruments with him for comparison.

M. JELINEK (T).—It was desirable to assure oneself from time to time that the standards were themselves unchanged.

M. NEUMAYER said, that the inspection of every station, had in Victoria been made an indispensable preliminary to the publication of its returns. Moreover, the directors of the principal Australian observatories had arranged for mutual comparison of instruments.

After discursive, though interesting conversation, respecting the construction of thermometers, it was resolved that it was desirable to inspect as frequently as possible.

20. *What are the rules and what the intervals of time for which the means of the several Meteorological elements should be calculated? Which is the better plan, to begin the Meteorological year with December or with January?*

Prof. DOVE (W).—Five-day means, beginning with January 1st. Civil year, and months.

SR. F. DA SILVEIRA (W).—Five-day means, decades [ten days? Ed.] months, seasons, and year. We think January is preferable, although at present we begin with December.

M. CARL FRITSCH (W).—Means should be taken for each day, month, and year. If separate means are given for the seasons, the year should begin with December; if otherwise, then with January.

Capt. HOFFMEYER (W).—Dr. Buys Ballot's division of the year, December–December into twelve periods of 30 or 31 days seems suitable.

DR. MOHN (W).—Length of intervals depends on working power of central station. Monthly means should always be given.

Prof. RAGONA (W).—Five-day means, decades, months and years. The 5-day means reckoned consecutively from January 1st, but the year should begin with December.

MR. SYMONS (W).—On the whole January 1st is preferable.

The BORDEAUX MEETING (W).—The most important period is the day, then the month, season and year. Any other period can be formed from these.

M. PRESTEL (T).—December was best, and in support thereof referred to the temperature curve at Emden.

Mr. BUCHAN gave several instances in which M. Prestel's argument failed, and spoke in favour of January 1st.

M. HANN also pointed out that a system to be adopted all over the globe should not be regulated by the conditions of any one spot.

Mr. SCOTT remarked that he began with January.

M. BUYS BALLOT was in favour of December, because otherwise the winter was partly in two volumes.

M. WILD remarked that it made no difference; no month had any physical basis, and therefore it was much better to adhere to the civil year.

M. JELINEK (T) it immaterial; most systems began with January.

M. PRESTEL urged the importance of seasonal means for agricultural purposes.

M. VON FREEDEN said in the Prussian system December was made the commencement of the year for that very reason.

M. VON OETTINGEN (T) monthly means were a mistake; he would begin with December 2nd.

M. BRUHNS advocated daily, 5-daily, and monthly means. He also always computed the means for both the civil and the meteorological year.

Mr. BUCHAN (T) daily, monthly, and civil year means were best. He thought seasonal means often delusive.

Mr. SCOTT gave 5-day, monthly, and (civil) yearly means.

On a division the majority was for, Days, 5-days, civil months, and civil years.

The meeting proceeded to discuss the mode of forming the 5-day periods, and on another division, Prof. Dove's method was adopted.

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## GREAT FLOOD AT LLANFAIRFECHAN, NORTH WALES.

Tuesday, April 15th, was a very warm day; Wednesday morning was still, warm and close; soon after noon rain began to descend in hasty showers, and unusually large drops; then came lightning and thunder, which continued for several hours incessantly. Looking eastwardly at the heavens over and beyond Penmaenmawr mountain, the sky was exceedingly dark and gloomy. About 3 o'clock p.m., the river which comes down from the mountains became exceeding full, the water almost black with peat colouring, then, after a time, the water changed to a very dirty red. The flood was at its height about 4 o'clock. The river had transgressed all its usual bounds, and the

rush and roar of the water, and the growl of the rolling boulders, were truly fearful. Four houses standing near the stream were carried away and lost in the flood; they seemed to have vanished, as it were, in a moment, and not a trace of them is left; the inhabitants had only time to escape with their lives, losing everything. Another house and a butcher's shop, and a small brewery and malt house, standing too near the stream, shared the same fate. Several wood bridges crossing the river were carried away. The force of the water was so great, that the wood-work of the washed down houses, brewing utensils, &c., &c., was broken all into fragments. Trees brought down by the torrent were strewn in all directions, many of them buried deep in the rolled down boulders and gravel.

The road up the valley was completely swept away in many places, and numbers of the nicely cultivated gardens of the cottagers are completely ruined, the soil being entirely gone, and nothing but boulder stones and gravel remaining; so complete is the ruin, that it would be next to impossible to say where the gardens were.

Going downwards towards the railway and the sea-shore, the course of the river is filled up with thousands of tons of stones, and gravel, the removal of which will be an immense work.

It appears that the centre of the downpour of water was about the ridge of the mountain called Tal-y-fan, the slopes of which descend north-westwardly towards Llanfairfechan, northwardly towards Penmaenmawr, and eastwardly towards a village called Roe-wen, in the valley of the Conway. At all those places the water rushed down, doing great damage. In the valley of the Conway, bridges have been carried away, and much injury sustained.

I have heard that there was some man on the mountains at the time, who describes the scene where he was as truly awful. There was almost the darkness of night, and the lightning and thunder were incessant, with occasional very heavy peals with a peculiar rattle, and the rain descending in torrents.

At the head of the Llanfairfechan valley, there are three mountain streams, which there unite and form the Llanfairfechan river. One of them rises in the watershed in the east, the middle one rises in the south-east, and the third rises in the south. It was down the first of these little rivers that the flood descended with immense force, the two other rivers shewing no marks of any very great increase of water in them. This would show that the great rainfall which caused the flood at our village was confined to a limited watershed of about a mile and a half from S.E. to S.W., by a mile from N.E. to N.W. The fall of rain over this limited area must therefore have been immense.

The rainfall at Llanfairfechan village during the whole period was only 1 inch.

RICHARD LUCK.

*Plas, Llanfairfechan, 28th April, 1873.*

## "CYCLONE AND ANTI-CYCLONE."

*To the Editor of the Meteorological Magazine.*

SIR,—I am glad to see in your pages some discussion on the subject of the propriety of the term "anti-cyclone," involving questions of importance.

Dr. Burder's letter contains what appears to me a serious error. If I rightly understand him, he regards the systems of atmospheric circulation which are termed "anti-cyclonic," as simply the interstices or spaces intervening between areas of depression. This is a mistake into which some English meteorologists seem especially liable to fall, as the result partly of the amount of attention devoted to storms, (which are principally of the "cyclonic" type) on our coasts, to the comparative neglect of the more tranquil motions of the atmosphere, partly of the somewhat greater frequency of the "cyclonic" than of the "anti-cyclonic" circulations within the limits of the British Isles.

I have at hand a very large list of examples of areas of high pressure quite as circular in form and far more stable and permanent in respect of geographical position than any areas of depression, and, if desired, I shall be glad to supply dates, descriptions, or charts of these *ad libitum*; though I am quite sure that any one who has worked much at weather charts, even for the British Isles alone, will have met with plenty of such instances.

In our part of the globe there are occasional periods during which circulations of the retrograde type prevail so largely that there are no true "anti-cyclones"; several depression systems are then nearly in juxtaposition, and the spaces of relatively high pressure necessarily existing between them approximate, as represented on an isobaric chart, to the form of all spaces existing between contiguous circles. Periods also occur, (rather less commonly in our Islands, but as commonly in Continental Europe), in which circulations of the direct type are prevalent, and these are sometimes nearly in juxtaposition, so that the spaces of relatively low pressure are those of the above mentioned form; and there are then no true "cyclones." It would almost seem as if Dr. Burder had confined his investigations to periods of the former description. From a similar treatment of those of the latter, any one so disposed may show by the same arguments and by the use of the same arrows, that "cyclones" are nonentities, except as the inter-spaces of the "anti-cyclones."

I cannot, however, reconcile Dr. Burder's remarks on this point with his mention of an area of barometric elevation, as represented by a circle or by concentric rings, for a mere space between circles, which he considers an "anti-cyclone" to be, is by no means a circle.

A causal relation exists just as much between each centre of barometric elevation and the rotation of the winds about it, as between each centre of depression and the rotation of the winds about it, and the student of meteorology who is impressed with the idea of the latter alone will resemble the physiologist who studies the venous to the

neglect of the arterial circulation, or the movements of inspiration to the exclusion of those of expiration.

With regard to the use of the terms "cyclone" and "anti-cyclone," I venture to submit that these are in a high degree both succinct and descriptive, and are therefore just what is much wanted in our terminology. They ought to be welcome to any one who knows the trouble of the alternative between using an incorrect or inadequate word, and employing, perhaps several times in a sentence, some such fearful phrase as "an approximately circular area, bounded by isobarics, having lower [or higher] pressures than those of the surrounding regions, and currents retrograde in the Northern, and direct in the Southern hemisphere [or vice versa], &c."

It is therefore satisfactory, I think, to see indications that the term "cyclone" is coming into more general use, as applied to our ordinary depression systems. Though originally employed only of certain depressions of exceptional intensity, it does not seem necessarily to involve either any comparison between these and our ordinary systems, or any theory as to the identity or otherwise of the atmospheric conditions which originate them; and it may be applied to either, just as the term "thunderstorm" is, either to the mildest shower of the kind in our own climate, or to the most violent electric tempests of some of the warmer regions of the globe. But should the term "cyclone" be ever thus popularized, its faithful and necessary correlative will be so too.—I am, Sir, yours truly,

W. CLEMENT LEY.

*Breinton, Hereford, April, 23, 1873.*

### THE APRIL FROST.

*To the Editor of the Meteorological Magazine.*

SIR,—The cold of last week was more severe than we ordinarily experience at the end of April. Perhaps the following figures may be of interest for comparison with those recorded elsewhere. Thermometers in louver board screens, 4 ft. above ground, except where otherwise mentioned :—

April, 1873	HARPENDEN, 350 ft.				ANEMOMETER STATION, 416 ft.			
	Max. at 4 ft.	Min.	Min. on grass.	Max. in sun at 4 ft.	Max. at 4 ft.	Min.	Max. 18 ft. above ground	Min.
23.....	48·7	31·3	22·8	114·0	45·8	31·3	44·7	31·7
24.....	46·2	29·6	21·2	107·8	—	29·5	—	29·7
25.....	48·1	24·0	11·7	112·2	45·2	27·9	43·0	29·0
26.....	48·5	22·8	11·8	99·0	48·7	26·6	47·4	27·5
27.....	46·9	30·8	23·7	101·0	—	33·5	—	36·0

The air was very dry till midday of the 26th, and radiation, both solar and terrestrial, was excessive. On the 25th the mean temperature of the air was about 36°·4, and the dew-point 25°·5. There were snow showers on the 23rd, 24th, and 25th, and hail fell on the 27th, on which day the wind had the force of a gale (30 miles an hour), for two hours. Plants are less injured than one would expect.

I am, Sir, yours truly,

F. W. STOW.

*Harpenden, April 30, 1873.*

## THE METEOROLOGICAL COMMITTEE AND THE SCOTTISH METEOROLOGICAL SOCIETY.

WE are very glad that the wish expressed in our last that the antagonism between these two bodies would be removed before the issue of this number of the magazine has been gratified. The following extract speaks for itself:—

“SCOTTISH METEOROLOGICAL SOCIETY.—At a meeting of the Council of this Society, held on the 28th ult., a letter was read from the Board of Trade transmitting a communication from the London Meteorological Committee, in which that body consented most readily to conform to the wish of the Scottish Meteorological Society, that observers furnishing information to them should not be engaged to observe also for the Committee without the previous concurrence of the Scottish Meteorological Society. The Council resolved to communicate to the Board of Trade their complete satisfaction with the result of this correspondence as to the complaint which they felt obliged to make regarding the interference of the London Meteorological Committee with their observers.

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### REVIEW.

*Saint Swithin and other Weather Saints.* By REV. LEONARD JENYNS, M.A., F.L.S., F.G.S., &c. [Proc. Bath Nat. Hist. and Antiquarian Field Club. Vol. II. No. 2.] 8vo. 30 pages. *Chronicle* Office, Bath.

THE author of this paper is one of the little band whose observations reach back to the early years of the present century. It is fifteen years since his excellent “Observations in Meteorology” was published, forty-three years since he commenced his observations at Swaffham Bulbeck, with standard instruments of the best construction, and we know not how many more years since he first commenced to record observations in Meteorology.

He consequently brings to the consideration of the above subject a mind trained in the school of systematic observation, and stored with the experience of more than half-a-century; those who are acquainted with his other works will, therefore, form high anticipations respecting this,—and they will not be disappointed.

Mr. Jenyns originally intended to treat of weather proverbs in general, but found that their number and variety was too great to be attempted at once, hence the limitation implied by the title of the paper.

He groups the saints according to the weather associated with them, deposes St. Swithin, at any rate from his supremacy, and quotes various authors in support of St. Vitus, (June 15); St. John the Baptist, (June 24); St. Simon and St. Jude, (October 28); Bullion's Day, (July 4); St. Medard, (June 8); St. Gervais, (June 19); the Festival of the Seven Sleepers, (July 27); St. Galla's, (October 5). Then he



notices the autumnal period most generally known as St. Martin's summer, and the claim to it on behalf of other Saints. The Icy Saints follow, *e.g.* :—

“ Saint Mamert, Saint Pancrace,  
Et Saint Servais,  
Sans froid ces Saints de Glace,  
Ne vont jamais,”

respecting which he remarks :—

“ The festivals of these Saints occur on three consecutive days, the 11th, 12th, and 13th days of May, and the noticeable thing is that these three days coincide with one of those short periods of anomalous cold, or wintry relapse, which occur in the earlier months, and of which that in May is, perhaps, the one most generally known ; thereby again establishing the truth of an old adage, though the phenomenon to which it bears reference has only of late years, comparatively speaking, attracted the attention of meteorologists, or been clearly ascertained to be a fact.”

The above is a fair specimen of Mr. Jenyns' mode of treatment, and will suffice to confirm the general tenour of his conclusions, that though in many cases the connexion is accidental or imaginary, there are others in which the proverbs are based on a substratum of truth ; some of the dates which we now hear of in connexion with “ weather saints,” for the first time, have long been known (or fancied) by ourselves as identified with weather of the very type assigned to them. This looks like a coincidence—and something more.

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# APRIL, 1873.

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.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.			Min.				
				Dpth	Date.	Deg.	Date.		Deg.	Date.			
											Inches.	inches.	
I.	Camden Town .....	55	—	58	12	28	11	75.5	15	29.9	25	3	11
II.	Maidstone (Linton Park) .....	81	—	41	15	18	15	81.0	16	26.0	26	5	11
III.	Selborne (The Wakes) .....	54	—	96	14	17	9	70.2	16	25.0	26	7	11
IV.	Hitchin .....	83	—	17	30	4	11	67.0	15	25.0	24	6	...
V.	Banbury .....	44	—	72	11	26	12	70.0	16*	29.0	26	4	...
VI.	Bury St. Edmunds (Culford) .....	1.31	+	56	34	26	12	71.0	16	25.0	25	8	14
VII.	Bridport .....	78	—	70	26	18	9	70.0	16	27.0	26	4	...
VIII.	Barnstaple .....	1.11	—	90	40	16	10	66.0	21	31.5	26	...	...
IX.	Bodmin .....	66	—	1.04	13	16	12	68.0	15	30.0	26	1	5
X.	Cirencester .....	82	—	47	24	6	10	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall) .....	78	—	37	24	16	10	67.0	15	27.0	26	5	...
XII.	Tenbury (Orleton) .....	87	—	67	37	16	12	71.7	15	28.7	26	5	12
XIII.	Leicester (Wigston) .....	57	—	73	14	27	10	75.0	15	28.0	25	...	...
XIV.	Boston .....	66	—	31	21	6	16	72.0	15	30.0	26	...	...
XV.	Grimsby (Killingholme) .....	71	—	...	20	26	15	59.0	30	31.5	26	...	1
XVI.	Derby .....	46	—	97	17	6	9	71.0	15	29.0	26	2	...
XVII.	Manchester .....	52	—	1.24	17	30	9	74.0	15	28.0	26	3	13
XVIII.	York .....	80	—	30	16	6	14	63.0	15	30.0	26	3	...
XIX.	Skipton (Arneliffe) .....	69	—	2.35	21	7	10	...	...	...	...	...	...
XX.	North Shields .....	1.06	—	25	23	22	17	57.4	30	29.6	25	2	3
XXI.	Borrowdale (Seathwaite) .....	1.76	—	5.14	1.00	1	10	...	...	...	...	...	...
XXII.	Cardiff (Ely) .....	31	—	1.62	24	17	4	...	...	...	...	...	...
XXIII.	Haverfordwest .....	96	—	90	49	16	7	68.0	17	28.0	25	4	13
XXIV.	Rhayader (Cefnfaes) .....	1.87	—	02	97	16	...	66.0	...	26.0	...	...	...
XXV.	Llandudno .....	1.04	—	46	60	16	7	67.0	15	33.4	26	...	...
XXVI.	Dumfries .....	14	—	1.53	04	15	8	70.0	21	30.0	24	5	11
XXVII.	Hawick (Silverbut Hall) .....	60	—	...	13	24	9	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill) .....	20	—	...	08	15	7	64.4	22	27.2	24	6	...
XXIX.	Castle Toward .....	39	—	2.11	13	17	6	69.0	21	...	...	4	...
XXX.	Leven (Nookton) .....	29	—	96	09	2	11	59.0	21	28.0	21	5	21
XXXI.	Stirling (Deanston) .....	38	—	1.37	11	2, 3	10	70.0	21	26.4	21	11	16
XXXII.	Logierait .....	78	—	...	25	19	11	70.0	20	19.0	28	7	...
XXXIII.	Braemar .....	1.74	+	34	42	6	15	61.8	20	26.3	24	8	15
XXXIV.	Aberdeen .....	1.02	—	...	13	6	18	57.5	30	31.8	24	1	13
XXXV.	Inverness (Culloden) .....	87	—	60	12	5	22	57.7	16	34.7	24	0	13
XXXVI.	Portree .....	1.57	—	3.70	25	29	13	...	...	...	...	...	...
XXXVII.	Loch Broom .....	3.05	—	...	44	28	19	...	...	...	...	...	...
XXXVIII.	Helmsdale .....	2.40	—	...	41	5	20	...	...	...	...	...	...
XXXIX.	Sandwick .....	1.44	—	30	18	4	17	53.4	20	31.6	25	1	4
XL.	Caherciveen Darrynane Abbey .....	2.26	—	...	65	13	15	...	...	...	...	...	...
XLI.	Cork .....	1.98	—	...	98	13	8	...	...	...	...	...	...
XLII.	Waterford .....	1.02	—	1.21	34	13	8	63.0	19†	30.0	1, 13	4	...
XLIII.	Killaloe .....	2.71	+	58	78	18	13	69.0	14†	27.0	25	5	6
XLIV.	Portarlinton .....	2.13	+	11	56	1	18	63.0	19	29.0	24	5	...
XLV.	Monkstown .....	62	—	1.02	21	17	6	...	...	...	...	...	...
XLVI.	Galway .....	3.22	—	...	1.23	16	13	70.0	17	31.0	24	2	...
XLVII.	Bunninadden (Doo Castle) .....	1.29	—	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown .....	45	—	...	14	3	7	71.0	22	27.0	25	4	10
XLIX.	Edenfell (Omagh) .....	56	—	...	10	3	15	62.0	21	26.0	24	8	...

\*And 17. †And 22, 30. ‡And 15.

+ 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.—A dry month; TS on 6th and 17th; very cold from 5th to 13th, then four very warm days, followed by drying N.E. winds, with sharp frosts from 23rd to 27th. Ice nearly half-an-inch thick on 26th, but the atmosphere being dry it is hoped the damage to fruit trees is not serious. Cuckoo heard on 13th.

SELBORNE.—An extremely dry month and very bleak; prevailing winds N.E.; L in the evening of 15th, and faint in evening of 16th, and TS at 1 a.m. on 17th. H at 11 a.m. on 6th and on 23rd; a few flakes of S at 3 p.m. on 23rd, and a little also on 24th; white frosts on 2nd and 20th.

HITCHEN.—Lowest temperature (at this season) since 1855.

BANBURY.—Aurora between 8 and 9 p.m. on 1st; slight snow on 6th, 24th, and 25th.

CULFORD.—A month of almost sunless weather, with T, H, and S on 6th and 23rd; H on 24th, S on 25th; swallows first seen and nightingale first heard on 14th. The cuckoo was heard on 16th, and soon after that the weather became colder, and he has not been heard since; polar winds have prevailed during 20 days; on the morning of 29th, the wind changed to the W., and the weather became slightly more mild but still continued sunless; the mean temperature of the month was 45°·8.

BRIDPORT.—North-westerly gale on 6th; TS on 14th; L on 15th, 16th, and 17th; very fine dry month and generally mild; chestnut in leaf on 5th; cuckoo heard on 12th.

BODMIN.—Average temperature 51°·5. The difference between the wet and dry bulbs on 19th was 11°; the difference between the temperature on the grass and at 4 ft. from the ground was 13° during the night of the 28th.

HAUGHTON HALL, SHIFNAL.—The month came in mild as March went out, but with the exception of two days (15th and 16th), when the temperature reached 67° and 65° respectively, it was for the most part cold and ungenial; vegetation making little progress, owing to the cold E. winds from 9th to 23rd, and the equally cold ones from the N. and N.W.; sad losses among the ewes and lambs; S and H fell on 6th, with TS in N.E.; L at night with heavy R on 16th; S and H again on 23rd, 24th, and 25th; large humblebee first seen on 2nd; white butterfly on 15th; apricot blossom most scantily on 3rd; hawthorn bursts on 9th; willow blossoms on 10th; blackthorn blossoms on 22nd; wild cherry on 24th; blackcap heard on 15th; willow wren on 22nd, and swallow on 16th.

ORLETON.—A cold dry month, with rough winds and little sunshine; warmer from 14th to 21st; severe frosts on the morning of 24th and 26th; L seen on 15th and 16th, and much distant T heard from 8 till 9.30 p.m. on 16th; temperature of the month rather more than 2° below the average; cuckoo first heard on 19th; swallow seen on 18th and redstarts on 16th, but no white throats during the month; cherry trees and damson trees in bloom about the 20th.

WIGSTON.—A very dry month, with great range in the temperature; upon the whole an ungenial month; easterly winds prevailing, which have retarded vegetation; T on 15th and 16th.

BOSTON.—Swallows appeared on 13th, but decidedly did not make a summer, the weather at the latter part of the month being cold and wintry; S falling on 23rd, 24th, and 26th; T SS on 6th and 15th.

GRIMSBY.—The month very ungenial, the pastures and corn lands on the heavy soils looking very backward and bare; after the 4th northerly winds prevailed till the last day of the month; cuckoo heard on 16th, and willow warbler on 26th; swallows seen on 17th.

DERBY.—The temperature during the first part of the month was remarkably high, rising on 15th to 71° in the shade, and 115° in the sun, the usual maximum

in sun in the hottest days of June and July being only (as recorded by the solar thermometer)  $130^{\circ}$ , or  $15^{\circ}$  above that of 15th; vegetation very dormant, not having any of the warm showers usual in April, and owing to the great evaporation caused by the cold winds.

MANCHESTER.—L in after part of 14th; S on 24th.

YORK.—S on 24th, 25th, and 26th.

NORTH SHIELDS.—Aurora on 18th and 19th; S on 22nd, 23rd, 24th, and 25th.

SEATHWAITE.—More than 5 in. below the average. Total fall 1.76, of which 1.00 fell on 1st. TS, with H, on 6th.

## W A L E S .

Haverfordwest.—One of the coldest and driest Aprils of which I have any record; from the 7th to the 12th and from 20th to 27th very wintry, thermometer not higher than  $35^{\circ}$  on twelve nights; vegetation very backward; cuckoo heard on 24th. Notwithstanding the enormous rainfall of the winter, water is becoming scarce, and some of the wells already show signs of failure; from 14th to 18th was remarkable for sudden and unusual rise in the temperature; air sultry and much L on the night of 16th; splendid aurora (pink and yellow) on night of 18th.

CERNFAES.—The month cold and frosty, wind generally either N.E. or N.W., much T and L; on 16th heavy and continued TS for six hours; rain almost identical with average.

LLANDUDNO.—T heard on 15th, and severe TS in afternoon of 16th. S on the distant hills during the first week, and again on 24th and 25th. S at 8.30 p.m. on 25th. H at 8 a.m. on 26th; cuckoo on 29th. The general character of the month has been dry and sunny, but with cold winds.

## S C O T L A N D .

DUMFRIES.—The weather throughout the month has been very dry, with frequent frosty nights; such a dry April has not occurred for at least twenty years, the rainfall being less than one-tenth of the average. On 23rd and 25th slight snow showers; from 14th to 21st very warm by day; on 21st the difference between night and day temperature was  $38^{\circ}.5$ ; mean temperature of month  $48^{\circ}.3$ , or  $1^{\circ}.5$  above that of April, 1872. Pastures suffering much from want of rain.

SILVERBUT HALL, HAWICK.—A month of cold E. winds. Hills white with S on 6th, 7th, 24th, and 25th. Swallows first seen on 17th. Sheep pastures suffering dreadfully from frost and drought, and a more barren April has not been known here for many years.

ANNANHILL.—Bar. high and equable; temperature variable, and  $4^{\circ}.6$  above that of preceding month; prevailing winds E. or N.E. Month generally fine; rainfall very deficient, ozone fairly developed. Pastures improving, but still backward; fruit trees coming rapidly into leaf; oats and all cereals much in want of rain.

CASTLE TOWARD.—A fine dry month; severe frost on the mornings of 24th and 25th, doing much mischief to tender and unprotected plants, in many cases the leaves have a scorched appearance, and even pansies and other flowering plants suffered greatly, but under the influence of fine weather the sowing of cereals is nearly finished. On the 30th a welcome rain refreshed our fields and gardens.

NOOKTON.—H on 6th, 7th, and 23rd; aurora at 9 p.m. on 18th; prevailing wind E.; R much below the average.

DEANSTON.—The driest month here for a long time; fine seedtime, and crops look well. Pasture fields in want of rain; N. winds very prevalent throughout the month.

ABERDEEN.—A tolerably dry though rather dull month, and with low temperature; winds N.W., N. and S.E. much more frequent than the average; estimated pressure a little under the average. Aurora on 10 nights, H on 8 days, fog on 4 days; temperature on grass  $20^{\circ}.5$  on 21st, and in sun, in vacuo, on 29th  $117^{\circ}.0$ . T on morning of 2nd.

CULLODEN HOUSE.—Solar halos on 13th and 15th; aurora on 19th.

PORTREE.—The driest month of April since 1861, but more frost than usual. The crops were never got into the ground in better condition than they were this season.

LOCHBROOM.—With the exception of the end of the month, which was cold and stormy, the month was a very favourable one for out-door labour and all agricultural and grazing purposes, the crops were never got into the soil in better condition, and stock continued in prime order during the whole of the spring, and this month is no exception.

SANDWICK.—From 5th to 11th, and again from 20th to 29th, there were cold N. and N.W. winds, with sleet or hail showers. Auroræ on 5 nights, that on 17th being brilliant and corruscating to zenith and south horizon.

#### I R E L A N D .

MONKSTOWN.—Month extremely dry, with cold northerly winds; vegetation very backward, but now advancing rapidly; swallows appeared on 15th.

GALWAY.—T and L on 16th, 19th, and 20th.

DOO CASTLE.—One of the finest months of April ever remembered here; crops put in under the most favorable circumstances. Farmers are now complaining for want of rain.

WARINGSTOWN.—Grass very backward in consequence of the prevalence of the N. and E. winds, and young crops suffering from want of rain.

EDENFELL, OMAGH.—As a seed-time the month has been highly favorable, but vegetation has (especially during the latter part) made but little progress, owing to the dry parching days and frequent frosty nights.

### THE COMING SUMMER.

*To the Editor of the Meteorological Magazine.*

SIR,—When at Greenwich the rainfall of March amounts to an inch or more, and the mean temperature of the period from the 15th February to 16th March is below  $38^{\circ}5$ , the mean temperature of the following summer (reckoning from June to August inclusive) has *always* been below the Greenwich average of the last 50 years. 1814, 1820, 1821, 1832, 1836, 1838, 1839, 1845, 1853, 1855, 1860, and 1866 are all the instances since 1813 when the above conditions have occurred, and in every instance the sequel has been as above stated. This year the mean temperature of the corresponding period was  $37^{\circ}8$  and the rainfall of March about 1.3 in. at Greenwich, therefore the mean temperature of the summer (June to August inclusive) should be cooler than the average of the last 50 years. In cool seasons and even in most really cold summers we have some intervals of warm weather, at least for a few days. I do not expect that the coming summer will be an exception to this rule. One of these periods should begin about the commencement of August or end of July, and it ought to be a period of considerable excess of heat. At Greenwich, for several successive days at that time, the daily mean temperatures should be rather high. But it seems almost certain that the mean of July will be below the Greenwich average of the last 50 years.

GEORGE D. BRUMHAM.

May 3, 1873.

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

LXXXIX.]

JUNE, 1873.

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

## THE LEIPZIG CONFERENCE.

(Continued from page 58.)

21. *In what manner and for what intervals are the normal values for the individual Meteorological elements to be deduced?*

(This and all the following questions were referred to a Committee consisting of MM. Bruhns, Jelinek, and Wild, who will be hereinafter referred to as the Committee).

SR. F. DA SILVEIRA (W) From the longest possible series.

M. CARL FRITSCH (W) Five or ten years.

THE BORDEAUX MEETING (W) Great care must be taken; the duration of records at different stations is very variable, and embraces periods differing in character; the introduction of years into one term which are not in another appears to us fallacious.

The COMMITTEE recommended periods of 5 years, or multiples thereof.

M. VON OETTINGEN proposed the term lustral as descriptive of the five-year mean.

These proposals were adopted.

22. *Is it desirable and possible to publish the Meteorological Observations of a limited number of stations in each Country in a uniform manner, and within a reasonably short time after the Observations have been made?*

SR. F. DA SILVEIRA (W) Doubtless, but strictly uniform.

M. CARL FRITSCH (W) Possible, but not desirable apart from special objects.

CAPT. HOFFMEYER (W) Very important and desirable.

DR. MOHN (W) Yes.

DR. WOLF (W) Uniformity of publication cannot be secured; the conference should fix the minimum amount of information which is worthy of publication.

The BORDEAUX MEETING (W) Yes, publications of uniform size, giving identical data, from stations always grouped in the same order.

The COMMITTEE recommended uniform publications of observations made thrice daily.

After discussion, in which general approval of the proposal was expressed, the Committee were requested to prepare printed specimens for the Vienna meeting.

23. *How is the Exchange of the Meteorological Publications of different Institutions and different Countries to be carried out most speedily, safely, and simply?*

SR. F. DA SILVEIRA (W) By *free* transmission by post, the cost is at present restrictive. It should be authorized by an international convention, and there should be three deliveries per month.

M. CARL FRITSCH (W) Most simply and safely, if not most cheaply by post.

DR. MOHN (W) Monthly by book post.

The BORDEAUX MEETING (W) In France all such publications go post free, and if the "frank" stops at the frontiers, it is only because other States do not recognize it.

The COMMITTEE recommended for moderate sized parcels book post, for larger ones increased facilities should be rendered through the consulates.

M. BRUHNS recommended that existing institutions, such as the Smithsonian, should be utilized as far as possible.

24. *Is it desirable that in each country there should be established one or more central Institutions for the direction, collection, and publication of the Meteorological Observations?*

SR. F. DA SILVEIRA (W) Yes, and if possible one great international one to summarize their results.

M. CARL FRITSCH (W) Yes; more than one in each country, but it is above all things necessary to have men fit to take charge of such establishments.

DR. MOHN (W) Yes; they already exist in most European countries.

The BORDEAUX MEETING (W) Yes. We already have such an office in France, possessing merely a moral influence over its correspondents, furthering their work, giving them greater homogeneity and making them generally known.

The COMMITTEE recommended that there should be only one such Central Government Office in each country, but that Marine Meteorology should in all cases be kept distinct, and placed under a separate officer.

MR. BUCHAN said the Scottish Meteorological Society could not agree to there being only one Central office for Great Britain. The large volunteer staff of observers would not agree to be placed under government control.

MR. SCOTT pointed out that there were already several separate organizations in this country.

The CONFERENCE, by 14 votes against 6, decided that "It is desirable that in each country, one, or in case of necessity, several, Central Offices should be established, and that those for Sea and Land Observations should be separate."



25. *Does the interchange of Weather Telegrams appear so useful that it should receive a fuller development and a firmer organization?*

SR. F. DA SILVEIRA (W) Yes, and special provision must be made to secure promptitude of transmission for the telegrams.

M. CARL FRITSCH (W) Judging from past experience at inland stations, the extension of the system seems undesirable.

CAPT. HOFFMEYER (W) Yes, and efforts should be made to secure better stations, firmer international organization and increased promptitude of transmission.

DR. MOHN (W) Yes, especially for storm warnings.

THE BORDEAUX MEETING (W) Yes, but there must be greater celerity of transmission.

THE COMMITTEE reported that the present system should be further developed. (Although not included in the programme, a sub-committee consisting of MM. Buys Ballot, Buchan, von Freeden, Müller, Neumayer, and Scott, was appointed for the consideration of Marine Meteorology; they also discussed the question of Weather Telegraphy and nominated a committee to collect evidence upon the subject (see p. 72,) and this nomination was at this stage of the proceedings notified to the Congress.)

MR. SCOTT (T) A central office for Weather Telegraphy should be established in every country. The Director in each country should incorporate in its bulletin, and in ordering storm signals should consider, the observations made at some stations in neighbouring countries, but he should not be expected to supply detailed information of the weather except upon his own coast.

M. PRESTEL (T) A certain set of stations should be selected, and the telegrams from each should be sent to every other.

MR. SCOTT (T) M. Prestel's proposal impracticable, and would break down through excessive wordiness.

M. VON OETTINGEN (T) It was to be regretted that Germany took so slight a part in the system. He thought the transmission of deviations from normal values more important than that of absolute readings.

M. VON FREEDEN (T) It was often impossible to obtain the necessary normal values.

Eventually the subject was referred to the Marine Sub-Committee for report.

26. *What regulations should be adopted in order to carry into effect the decisions and the objects of the Meteorological Congress?*

M. CARL FRITSCH (W) Directors of all Central Offices should be requested to carry out the resolutions.

THE BORDEAUX MEETING (W) The Vienna meeting should have an official standing, the representatives being nominated by the various governments, so as to ensure full weight being attached to their recommendations.

THE COMMITTEE recommended that a full report of the proceedings

at Leipzig be drawn up, and that a permanent committee be appointed to prepare for the meeting in 1873.

M. BRUHNS stated the reasons for selecting Vienna, which was unanimously chosen.

M. BUYS BALLOT proposed MM. Wild, Jelinek, and Bruhns for the permanent Committee, and they were unanimously elected.

M. VON OETTINGEN proposed to establish a special organ for the publication of preliminary matter.

M. WILD (T) There would not be sufficient to render such a course necessary, besides which, it would be too irregular in date, and proposed that all such papers should be printed in the *Zeitschrift*.

M. JELINEK concurred, and the proposal was adopted.

#### MARINE SUB-COMMITTEE.

As before mentioned (although not in the programme) a sub-committee was nominated to consider the subject of marine meteorology ; it consisted of MM. Buys Ballot, Buchan, von Freeden, Müller, Neumayer, and Scott.

The following is an epitome of its decisions :—Central offices for marine meteorology should be established in all countries wherein they do not at present exist. Uniformity of instruments and modes of observation is desirable, but not so necessary as on land, and will be best attained by mutual agreement among the directors. Co-operation of the navies is most important, in order to secure completeness in all parts. Results must be discussed and utilized uniformly. The repetition of work [by different establishments] over definite regions must be declared indefensible.

The three following paragraphs do not seem quite clearly expressed either in the German or English reports, but we believe the following is nearly the true version :—Some proposal having been made for the gratuitous interchange between Directors of MS. observations, Mr. Scott said that the Meteorological Committee had resolved to charge for copies of any scientific documents ; M. Buys Ballot remarked that he, on the contrary, had never charged for such copying, and the proposal was unanimously agreed to. M. von Freeden however remarked that hitherto the matter had been arranged by mutual agreement, and that pressure could hardly be exerted. The decision of this sub-committee respecting weather telegraphy has been previously cited.

With the reception of this report of the sub-committee, the business of the Conference terminated.

A SEQUEL TO THE SUGGESTIONS ON A UNIFORM  
SYSTEM OF METEOROLOGICAL OBSERVATIONS,  
BY DR. BUYS BALLOT.

[We have already drawn the attention of our readers to the above quoted work, and made arrangements whereby they can easily obtain copies. We are glad to find in the *Zeitschrift* for May 15th, a review of it by no less an authority than Dr. Jelinek, the following translation of which will, we are sure, be acceptable to many of our readers, and well worthy of the space which it occupies; besides which it might not otherwise have been accessible in the English language.—Ed.]

THE task of the Meteorological Congress in Vienna, towards which we may now look with some confidence,\* will be considerably facilitated by the preliminary discussions which have taken place at Leipzig and Bordeaux, and by the written utterances, for which we have to thank several prominent meteorologists.

Prof. Buys Ballot has won great merit in this direction, first by his "Suggestions on a Uniform System of Meteorological Observations," published before the Leipzig meeting, and now again by the above cited work.

Both papers are devoted to the points raised in the programme which was laid before the Leipzig meeting. The time at the said meeting being rather short for the discussion of such numerous questions, Prof. Buys Ballot's present work is a useful supplement to the record of the proceedings of the Congress.

We take the liberty of remarking that on the first page the name of Director Wild is missing among the managers of the Leipzig meeting, who was most prominently active in it, and from whom emanated the programme, including the majority of the points discussed.

With respect to the significance of the questions treated at Leipzig, we coincide with the worthy author, when he lays the chief stress on a corresponding choice and distribution of the stations (especially out of Europe), as well as on the most suitable form for the publications. The points just mentioned are such as shortly require intervention on the part of the Meteorological Congress, and respecting which an agreement might well be arrived at without difficulty.

We cannot quite agree with the author (page 2) when he proposes leaving the choice of the observational methods and instruments wholly to the free judgment of single observers and directors. Meteorological observations, reaching over several countries, demand in the first place, like all statistical operations, the possibility of comparing the data on

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\* The Imperial Austrian Ministry of Instruction has answered affirmatively to the petition presented to them in accordance with the resolutions of the Leipzig Conference, concerning the invitations to the Congress, and other requisite measures.

which they are grounded, which can only then be guaranteed when a uniformity of the methods and of the applied apparatus is, at least to a certain degree, established.

On question 3 the author introduces a remark as made by me, that aneroid barometers perhaps might be found useful as a check on quicksilver barometers during the inspection of stations. I take the liberty of stating that this remark emanated from Mr. A. Buchan. My opinion is that aneroid barometers should be admitted to stations of the second order, when it is a question, not of the absolute value, but only of the variations of the air pressure. As long as an aneroid is not exposed to shocks (as when carried about), it goes pretty exactly parallel with a good quicksilver barometer,\* and is much easier to be read off by unpractised observers than the latter, so that the errors in reading off met with by every leader of a large system of observations are lessened. As a check on station barometers, I consider the aneroid less adapted, as its correction is far too easily altered by shocks. In order to be something like on the safe side, it would be necessary to carry three aneroids about with one; in that case the coincidence of two of them would offer some probability that the corrections of the same had not altered. At the fifth question of the Leipzig meeting, as to what instruments are applicable to the observations of radiation, the author recommends (page 9) the establishment of observational stations on high mountains, which should be furnished with the necessary apparatus, especially with spectroscopes. We agree thoroughly with the author, but beg, however, to remark here, that for the carrying out of such series of observations, scientifically educated observers, or proper physical expeditions, would be required, while at present one has generally less trained observers at mountain stations, than at those of less altitude.

With regard to the object of the ground temperatures (question 6), the author agrees with Buchan and the French meteorologists therein, that such observations possess greater value for the botanist than for the natural philosopher or meteorologist. For the physiology of plants and the enquiry into the laws of their growth, it would suffice to observe thermometers at a depth of 4, 8, and 12 in., and perhaps electrical thermometers for depths of 19, 27, 39, 59, and 79 in., the last for trees which have their roots at these depths. It would suffice for meteorological experiments to observe one or two of these thermometers, in order to derive from their indications in what manner the differences of temperature depend on the nature of the ground. For questions of physical geography electrical thermometers are required under the surface down to the stratum of unchangeable temperature at suitable distances one from another.

Few places are adapted for such observations. Many circumstances,

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\* Numerous comparisons of Naudet's Holosterics at the Vienna Central Institution give with regard to influence of temperature an average error of 0.2 mm. to 0.3 mm. (0.008 to 0.012 in.) However, these comparisons certainly do not range over a long space of time.

the nature of the ground, the downfall, which communicates the temperature of the high strata to the deeper ones, disturb the observation, and what has to be observed? The law of the conducting power for the warmth? If it be necessary to determine the quantity of warmth which flows from the interior of the earth through the surface, then the temperature must be enquired into at great depths. Only the Alps or other mountains can offer data of any value, yet as soon as a tunnel be driven through these they lose the attributed property, for the surface of the tunnel becomes continually cooled down by the air streaming through it, and nobody would wish to destroy the tunnel to the end that the thermometer might give correctly the true temperature of the earth at this depth.

With respect to the noting down of the *speed of the wind*, where numbering apparatus is used (question 10, page 16), the author declares for the units, meters, and seconds. We know very well that the Leipzig meeting expressed itself also in the same sense, yet it might be allowed to draw attention to the fact, that the sailor almost universally reckons the speed of the wind in sea miles per hour, or in kilometers per hour. The last unit is also used on the Continent, in Italy, Spain, Austria. The question arises whether the present usual unit is to be relinquished on the continent, when it is probable that the marine will hold to it? On page 17 the author recommends that the *time* should always be noted, when a wind has blown with a pressure of 30 kilogrammes per square meter, [6 lbs. per square foot]. We quite agree with this, but it is only practicable where one has a registering apparatus at disposal, and considering the class of the majority of anemometers in use, it were perhaps more to the purpose to fix a limit for the *speed* of the wind, than the pressure. The velocities of the wind are however extraordinarily varied according to the particular localities, and it might prove necessary in practice to take note of this when determining the before mentioned limit.

The importance of strict contemporary observations\* (question 18, page 26) for meteorological investigations, which comprise a greater part of the earth's surface, cannot be denied. The difficulty lies only herein, viz., that for other purposes observations made according to the local time are equally required, so that the burden of the duties of the observers is doubled, to which must still be added the circumstance that one or another of the synchronous observations may occur at a time very inconvenient to the observer. Such demands can by no means be made on volunteer observers, who are unremunerated, and who are occupied with other business callings; the synchronous observations must therefore be confined to the limited number of central observatories, which are besides mostly provided with registering apparatus.

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\* Prof. Buys Ballot very often makes use of the expression "astronomical time," in opposition to local time. It might be better to use instead of this "time of a first meridian," or "time of the synchronous observations," for as a rule the time used in astronomical calculations, refers to the *meridian of the locality*, and not to a fixed first meridian.

On page 33 the author speaks of the "Nouvelles météorologiques," which were published in the years 1868-1870 by the French Meteorological Society, which he calls a very valuable publication, and which it is to be hoped may be again undertaken before long. The form of the "Nouvelles météorologiques" appearing monthly, holding a middle place between a daily bulletin and an annual, seemed to us also a successful one. Whether the "Nouvelles météorologiques" be again taken up, or the "Bulletin mensuel" be continued, it would in any case, in the interest of French meteorologists, as well as of those of other countries who are referred to the above-mentioned publications, be desirable that they should possess a certain *stability*. With regard to the harmonizing form in which the observations of a station are to be published, the author proposes (page 34) 23 columns (with the date properly 24), viz., 3 for the atmospheric pressure, 3 for the temperature at the fixed hours of observation, 1 for the minimum, 1 for the excess of the maximum above the minimum, 6 for the vapour pressure (or the quantity of water contained in a given volume of air) and the relative moisture, 2 for the rain, 3 for the wind, 3 for the state of the clouds, 1 for remarks.

Director Wild has had the observations of a Russian station (Simferopol) printed, according to the views upheld at the Leipzig meeting, with the object of allowing meteorologists to express an opinion on the suitability of the arrangement. Wild's sketch only comprises 18 columns, viz., 1 for date, 3 for air temperature, 3 for relative moisture, 3 for height of barometer, 3 for direction and force of wind, 3 for state of clouds, 1 for downfall, 1 for remarks. By means of this arrangement it is possible to place *two* months observations of a station on one quarto page (325 mm. high and 245 broad) [ $12\frac{3}{4}$  by  $9\frac{1}{2}$  in.], which would be hardly possible in the case of Prof. Buys Ballot's proposal. Now the question of cost must by no means be left out in this matter, particularly as regards those countries where hitherto no original observations had been published. A result could only be obtained here on the supposition that the demands be limited to the extent of what is indispensibly necessary for meteorological labours. For this reason I would prefer the form proposed by Director Wild.

Further I do not think it was the idea of the Leipzig meeting, to publish annuals over and above these monthly sheets, which should contain the observations in a more detailed state. The scheme with which the committee formed at Leipzig, occupied itself, and which is now carried out experimentally by Director Wild, is precisely to establish uniformity in the annuals published by the central observatories. The summaries of the weather formed on the basis of the telegrams are intended for preliminary information of the atmospheric movements over large extents. It must certainly, however, be here assumed that the publication of the annuals speedily follow, in which direction the leaders of many systems of observation have struck out already with an example worthy of imitation.

In a notice (on page 35) the author discusses a plan of Koeppens,

published in the *Zeitschrift*, vol. viii., page 17, concerning the establishment of an "International Meteorological Institute." The author, while agreeing with the general plan of the distribution of the central observatories, and the establishment of similar new institutions, considers a convocation of 35 Directors too numerous, and fears these would exercise too great an influence on the separate observatories. The meeting should only facilitate communication between the separate central observatories, but not dictate to them their labours. We must admit that this reflection against Koeppen's proposal did not strike us; we do not find that he speaks of a council of 35 Directors, and it would still always be possible to preserve independence of the separate central institutions, in the organization proposed by him.

On page 37 the author repeats a proposal already made by him in a previous article regarding the "Aeroclinosope,"\* of a registration of the atmospheric conditions of distant stations by means of electricity, on page 40, that of a better distribution of the stations, so that especial care was to be taken for the erection of stations in Africa, South America, and the Polar regions.

In conclusion, the author discusses the observations *at sea*, and the manner and method by which the extracts had been obtained from the ship's journals at the Netherlands Meteorological Institution by the director of the Marine department, Mr. Cornelissen, and in what manner hereafter the meteorological conditions will be deduced of certain parts of the surface of the sea. The manner and method by which the best routes for ships, are ascertained at the said Institution, is also thoroughly explained. Consequently it is a rich addition of valuable materials, based on the observations and experiences of many years, which the esteemed Director of the Utrecht Meteorological Institution now places at the disposal of the scientific public in general, and the Meteorologist Congress at Vienna in particular.

C. JELINEK.

## CYCLONE AND ANTI-CYCLONE.

*To the Editor of the Meteorological Magazine.*

SIR,—Your readers will, I believe, thank me for having elicited from so high an authority as the Rev. W. Clement Ley an exposition of his views regarding "anti-cyclones."

The difference between us is sufficiently simple and definite. We agree that there may sometimes be observed about a centre of barometric elevation an apparent circulation of air opposite in direction to that which prevails about centres of depression. Mr. Ley conceives that "a causal relation exists just as much between each centre of elevation and the rotation of the winds about it, as between each centre of depression and the rotation of the winds about it." I have ventured to suggest that the only true causal relation is between the rotation of

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\* *Zeitschrift*, vol. iii., pages 402, 428, & 449.

the winds and the centres of depression, the other relation being accidental only, and illusory.

My remarks were limited to an endeavour to show that the supposition of this other relation was superfluous, the observed facts being capable of explanation without it. I do not find in Mr. Ley's reply any reason to abandon this position. It cannot, I think, be denied that if an area of barometric elevation be, as I have supposed, only a space between surrounding depressions, the effect of the retrograde rotation of the wind about these must be to produce a more or less distinct appearance of direct rotation about the centre of elevation, somewhat in the same way that a number of rotating cog-wheels placed in connection with a central cog-wheel will cause the latter to assume a rotation contrary in direction to their own. The analogy is not perfect, for according to my view there is no real circulation about the centre of elevation, although the direction of the wind at several detached spots may be consistent with such an explanation. To put the matter in a more concrete form, I should say that if a balloon were sent up at each of the points where the supposed circulation was observed, the balloons, after moving for a little time in conformity with the theory, would presently fall off each into its own system of circulation about a centre of depression.

Mr. Ley objects that if an area of elevation be only an interspace between surrounding areas of depression, it cannot be circular, but must have the form proper to interspaces between contiguous circles, whereas actually (he says) many areas of elevation are quite as circular as areas of depression. Mr. Ley no doubt means that the areas bounded by the isobaric lines about centres of elevation are often regular circles. But it must be remembered that these lines do not necessarily represent—indeed it is only by a rare chance that one of them can represent—the extreme outer boundary of the area. And whatever may be the irregularities of this outer boundary, it is easy to see that in a series of isobaric lines about the point of highest pressure, these irregularities may become toned down as the distance from their source increases, and finally obliterated.

Any one who will be at the pains to examine a sufficiently long series of weather charts, showing isobaric lines and currents of wind, may satisfy himself of the following differences between the characters of barometric elevations and those of barometric depressions.

First, the tendency to circularity of the isobaric lines is, on the whole, much more marked in the case of depressions than it is in the case of elevations.

Secondly, the intervals between the lines, as a rule, become smaller towards centres of depression; wider towards centres of elevation.

Thirdly, the force of the wind, being proportionate to the closeness of the lines, or the "steepness of the gradient," is generally strong in force, and definite in direction over areas of depressions, very light and inconstant over areas of elevation.

These differences seem to me to indicate unmistakeably a positive or



active character about the depressions, a negative or passive character about the elevations. For typical examples I refer the reader to the British Weather Charts of February 2nd and February 18th of the present year.

Mr. Ley is inclined, I think, to over-rate the advantage, in point of brevity, of the term for which he pleads. It would be possible to discard it without resorting to the portentous periphrasis which he puts forward as its alternative. "Area of elevation," although longer by four letters than "anti-cyclone," is by no means an unwieldy expression.

GEO. F. BURDER, M.D.

Clifton, June 10th, 1873.

### EARTHQUAKE AT DONCASTER.

*To the Editor of the Meteorological Magazine.*

SIR,—On 29th April last, at 2.40 p.m., a smart shock of earthquake was felt in this town and at a few places adjacent, the furthest we have heard of being Bawtry, 9 miles south, and Conisbro, 5 miles westward. We have no other report of such an event from any more distant part of the country. Considering the severity of the shock, this is perhaps more remarkable than the event itself.

I was at the time sitting in my chair reading, and was startled by a decided movement of the house, and a noise as of a heavy body falling in some up-stairs room—from the shock I judged heavy enough to have gone through any floor in the house. Hearing no sounds of alarm or further commotion, I went into an adjoining room, where two persons were employed (standing); to my surprise they had perceived nothing unusual; my expectation was, that there had been an explosion of gas in the cellars; on making further inquiry in the house, I found one of the servants had noticed a shaking of windows and noise overhead, which she could not account for.

We were, however, not long in doubt as to what had occurred; reports came in from all parts of the town, in the higher parts the shock was felt so severely that many people ran out of their houses in alarm; some people state they were thrown off sofas and chairs; no damage was done, however, excepting a few glasses being overturned and broken.

So far as I could judge, the movement was from west to east and back again, the noise no doubt arose from movement of the walls of the houses, the atmosphere at the time being clear and cool.

I am late in sending you this account, and am unable now to obtain one of the local papers containing their report; this I regret, as many details, too long for a letter, were given therein. Possibly a notice of the above in the *Meteorological Magazine* may elicit the fact that Doncaster cannot yet claim an earthquake entirely to itself.—Yours truly,

JAMES HOWORTH.

Doncaster, May 18th, 1873.

[We quite share our correspondent's surprise at so extremely local a shock.—Can it have been a genuine earthquake. Ed.]

## ON THE PRACTICABILITY AND UTILITY OF WEATHER AND STORM SIGNALS IN EUROPE.

[The following letter and questions are self-explanatory ; it is therefore only necessary to state that we have inserted them in the *Meteorological Magazine* with the concurrence of Mr. Scott, because we know that many of our readers are able, (and we hope willing) to supply useful replies to the several queries. It is almost superfluous to remark that all communications on the subject should be sent to Mr. Scott, and not to ourselves.--ED.]

116, *Victoria Street, London, S.W.*,  
30th April, 1873.

SIR,

The Sub-Committee appointed by the Meteorological Conference at Leipzig to draw up a Report on the subject of "the practicability and utility of Weather and Storm Signals in Europe," for presentation to the proposed Meteorological Congress at Vienna, have agreed to issue the following questions, in the hope that you and other gentlemen, to whom this letter may be addressed, may be disposed to favour them with your observations thereon.

They have agreed to issue the subjoined Series of Questions, and have furthermore arranged to divide among themselves the labour of communicating with the several gentlemen whose views it is of importance to ascertain.

The following is the arrangement adopted :—

M. BUYS BALLOT to communicate with	{	France, Spain, Portugal, Holland, Belgium, Italy, and the United States of America.
HERR NEUMAYER                   "           "	{	Germany, Austria, Switzer- land, and Norway.
MR. SCOTT                           "           "	{	Russia, Sweden, Denmark, Hamburgh, the United Kingdom, and its Colonies, &c.

I have the honour to be, Sir,  
Your obedient Servant,  
ROBERT H. SCOTT.

### I.

What are your opinions in respect of the action of the systems of Storm Signals hitherto in use, either from your own experience, or from a consideration of the Bulletins published in the United States, in England and in France ?

II.

Is it your opinion that in addition to communications of the Direction and Force of the wind which is actually blowing, the Barometrical "Gradients" should be given, in order to give warning of approaching wind?

To what should these gradients be referred? Viz. :—

A—To the differences between the actual readings at the different stations.

B—To 30 ins. at sea level.

C—To the mean normal heights of the barometer at the stations taken into consideration.

III.

In what way should we take into consideration Temperature, Vapour, &c., &c.?

IV.

If we assume that each Director will institute the proper arrangements in his own district, what do you recommend as the minimum that each Director should communicate to the Director of another district, and should receive from him in return?

V.

Are you of opinion that the present condition of our weather knowledge justifies us in issuing distinct prophecies or forecasts of weather in contradistinction to the simple Telegraphic communication of facts, or should we confine ourselves to indications of the condition of the atmosphere in adjacent countries, from which the recipients of the Report must draw their own conclusions? In the latter case should we communicate the general conditions by Signals visible from a distance, posting up, at the place itself, the detailed information received from other localities?

VI.

In what way can it be arranged that intelligence of the conditions of weather can be conveyed to ships at sea, by means of Semaphores or by Signals from Lighthouses?

## MAY FROST.

*To the Editor of the Meteorological Magazine.*

I have again to report an unusually severe frost, by which potatoe shoots have been killed, ash leaves blackened, and much other harm done. On the 20th May the minimum registered at 4 ft. was 24°·9 and 19° on grass. At my anemometer station, however, it was not below about 31° at 4 ft. and 35° at 18ft.—Yours, &c.

F. W. STOW.

*Harpenden, St. Albans.*

## MAY, 1873.

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	inches.	in.								In shade	On grass.		
I.	Camden Town .....	1·56	—	·84	·52	7	14	72·9	26	32·9	20	0	2
II.	Maidstone (Linton Park) .....	·97	—	1·27	·45	8	12	77·0	26	29·0	14	2	...
III.	Selborne (The Wakes) .....	1·90	—	·58	·51	7	11	65·6	26	26·5	20	2	4
IV.	Hitchin .....	1·80	—	·13	·29	7	16	68·0	30	30·0	19	2	...
V.	Banbury .....	2·48	+	·26	·40	5	16	70·5	3	30·0	20	2	...
VI.	Bury St. Edmunds (Culford) .....	2·16	—	0·00	·33	21	13	69·0	26	29·0	19	1	7
VII.	Bridport .....	·88	—	1·15	·27	7	8	70·0	30	30·0	20	1	...
VIII.	Barnstaple .....	2·30	—	·14	·60	20	11	72·0	14	37·5	20	...	...
IX.	Bodmin .....	2·10	—	·36	·73	7	13	67·0	29	38·0	4, 6	0	2
X.	Cirencester .....	2·60	+	·32	·55	7	15	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall) .....	2·70	+	·44	·56	5	14	65·0	26	33·0	18	0	...
XII.	Tenbury (Orleton) .....	2·38	—	·50	·68	5	14	72·0	12	30·8	20	1	8
XIII.	Leicester (Wigston) .....	2·03	—	·09	·25	5	11	71·0	29	31·0	19	...	...
XIV.	Boston .....	2·40	+	·46	·47	26	16	67·0	26	34·0	20	0	...
XV.	Grimsby (Killingholme) .....	2·29	—	...	·48	26	17	64·0	11*	33·0	20	0	...
XVI.	Derby .....	2·31	+	·15	·39	17	17	68·0	31	35·0	20	0	...
XVII.	Manchester .....	1·91	—	·75	...	...	17	...	...	...	...	...	...
XVIII.	York .....	2·25	+	·30	·42	5	15	63·0	26	33·0	20	0	...
XIX.	Skipton (Arncliffe) .....	2·55	—	·80	·47	5, 22	20	67·0	27	26·0	19	4	...
XX.	North Shields .....	3·04	+	·40	·50	5	22	61·7	21	33·0	20	0	1
XXI.	Borrowdale (Seathwaite) .....	5·58	—	3·96	1·70	20	17	...	...	...	...	...	...
XXII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest .....	3·25	+	·53	1·31	5	...	67·0	13	30·0	19	3	7
XXIV.	Rhayader (Cefnfaes) .....	3·41	+	·56	·57	30	9	71·0	...	30·0	...	...	...
XXV.	Llandudno .....	1·19	—	1·19	·26	17	11	67·7	31	35·5	20	0	...
XXVI.	Dumfries .....	1·63	—	·76	·33	16	15	69·0	31	31·0	19	3	7
XXVII.	Hawick (Silverbut Hall) .....	1·91	—	...	·38	16	15	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill) .....	...	...	...	...	...	...	...	...	...	...	...	...
XXIX.	Castle Toward .....	3·18	—	·21	·68	6	17	67·5	31	...	...	1	...
XXX.	Leven (Nookton) .....	2·77	+	·77	·66	5	16	64·0	1	30·0	4	3	15
XXXI.	Stirling (Deanston) .....	3·17	+	·52	·46	5	20	67·9	31	25·4	4	6	8
XXXII.	Logierait .....	2·43	—	...	·49	5	17	...	...	...	...	...	...
XXXIII.	Braemar .....	6·18	+	4·38	2·02	5	18	66·2	31	25·2	19	9	16
XXXIV.	Aberdeen .....	2·69	—	...	·95	5	19	63·5	21	33·4	19	0	15
XXXV.	Inverness (Culloden) .....	3·18	+	1·62	·74	6	20	56·6	31	34·7	16	0	9
XXXVI.	Portree .....	4·33	—	1·32	·99	5	18	...	...	...	...	...	...
XXXVII.	Loch Broom .....	2·39	—	...	·46	11	19	...	...	...	...	...	...
XXXVIII.	Helmsdale .....	2·43	—	...	·48	9	17	...	...	...	...	...	...
XXXIX.	Sandwick .....	1·71	—	·55	·38	1	14	...	...	...	...	...	...
XL.	Caherciveen Darrynane Abbey .....	3·03	—	...	·90	4	17	...	...	...	...	...	...
XLI.	Cork .....	1·47	—	...	·64	4	...	...	...	...	...	...	...
XLII.	Waterford .....	1·36	—	·89	·43	4	13	72·0	28	35·0	19	...	...
XLIII.	Killaloe .....	3·09	—	·09	·78	6	17	78·0	29	32·0	20	1	5
XLIV.	Portarlington .....	1·78	—	1·42	·28	8	21	71·0	30	32·0	18	1	...
XLV.	Monkstown .....	·67	—	1·24	·12	8	10	...	...	...	...	...	...
XLVI.	Galway .....	2·40	—	...	·44	17	16	69·0	16+	34·0	19	0	...
XLVII.	Bunninadden (Doo Castle) .....	2·45	—	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown .....	1·84	—	...	·38	16	13	75·5	25	28·5	7	2	9
XLIX.	Edenfell (Omagh) .....	2·36	—	...	·33	22	18	70·0	29	23·0	18	4	...

\*And 12. †And 29.

+ 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.—A dry cold month, the thermometer several times approaching a frost (even up to the end of the month), but only two were absolutely registered. T on 9th; barometer generally high; prevailing winds N. and N.E., and vegetation very backward for the end of May, but on the whole the frosts did less damage to the fruit blossoms than usual, the air being very dry.

SELBORNE.—On the 20th the temperature fell to 26°·5; many plants and trees cut—roses, oaks, beeches, ash, walnuts, &c.; hay crops not promising from want of rain; prevailing winds, first ten days S.W., last ten days N. and N.E. On 8th wind in early morning N.E., and S.W. in afternoon; T. at 6.30 p.m.; H at 2 p.m. on 27th, 13°·5 difference between the minimum temperature on 1st and 2nd, the 1st being 48° and the following days only 34°·5.

HITCHEN.—T on 27th.

BANBURY.—Hail and high wind on 3rd; TS on 6th.

CULFORD.—Another month of cold and sunless weather, with max. temp. lower than that of April preceding, being 69°·0 to 71°; a TS accompanied by H on the 3rd; T also on 9th and 23rd; sharp frost on the night of the 19th, which did much injury to vegetation, although a thermometer at 4 ft. from the surface of the ground, fell to only 29°; mean temp. of the month about 50°. Polar winds during 7 days; westerly or equatorial during 24 days.

BRIDPORT.—Another month of little rain, only 1·64 in the months of April and May; several sharp frosts, but that on the 20th though only slight, did more damage than any preceding frost.

HAUGHTON HALL, SHIFNAL.—The first part of the month was cold, with rain daily till 9th, including a continuous fall on two of the days (4th and 5th) of 1·03. The prevailing winds (with occasional changes to E.) were from N. and N.W., from the 20th it became somewhat milder, but on no day above 65°; vegetation backward but healthy; the eclipse on the 26th quite visible throughout, only veiled in fleecy clouds; cuckoo first heard on 2nd and turtle dove on 19th; flycatcher arrived on 22nd.

ORLETON.—A dry and pleasant month, but generally cloudy and cold, with a small proportion of bright days; the mean temperature about 1°5 less than the average; no T heard or L seen; frequent slight frosts in the mornings; generally a brisk drying wind, with very few calm days; great blossom on the apple trees in the middle of the month; the first whitethroat seen on the 1st.

WIGSTON.—Prevailing winds N.E.; the month, as a whole, has been ungenial, and has kept the pasture land very bare, and the corn, though looking healthy, is very backward; the mean temp. rather below the mean of the month; T at Leicester in the afternoon on 26th.

BOSTON.—Cuckoo heard on 9th; thorn may in flower on 21st; temperature first 20 days in May 48°, first 14 days of January 45°.

GRIMSBY.—Saw lesser whitethroat on 3rd; spotted flycatcher on 21st; apple began blossom on 12th; monthly rose on 28th; TS at noon on 3rd, at 11 a.m. on 8th, at 1.15 p.m. on 23rd, and at places near on 26th; grass rather scarce, and wheat in heavy lands looking thin; fair prospect of a fruit crop.

DERBY.—Mean reading of solar radiation ther. 109·8, max. 121·0 on 27th.

YORK.—TS with H on 3rd; T on 8th.

ARNcliffe.—Very dry, and average temp. of the month unusually low, especially in the nights. S on 17th.

SEATHWAITE.—S on hill tops on 3rd, 7th, and 17th; very little R.

## WALES.

HAVERFORDWEST.—A cold backward month, more like May, 1853, than any since that time; N. and N.E. winds prevailed throughout, with some sharp nights of frosts; drier than usual.

**CEENFAES.**—The month dry, cold winds, with more or less frost at night ; wind generally N., N.E., or N.W.

**LEANDUDNO.**—General character of the month warm sun, and cold wind, with very little rain ; swallows first seen on 1st ; lilac flower on 3rd ; honeysuckle on 19th ; hawthorn on 20th ; laburnum on 21st, and mountain ash on 26th. TS between 1 and 2 p.m. on 23rd.

#### SCOTLAND.

**DUMFRIES.**—The first half of the month dry and cold, with occasional slight showers. On morning of 19th all the hills covered with S, and the higher ranges were not quite free from S until near the close of the month. During the latter half of the month there were refreshing showers, with a higher temp., and vegetation was much revived. On the morning of 14th, the frost injured the early potatoes. The night temp. has been below, and the day somewhat above the average, thus making the mean nearly the same as last year. T on 22nd.

**FLAWICK.**—The month has been cold and unkindly towards vegetation ; early potatoes sadly nipped by the frosts of the 16th, 17th and 18th. The hills were white with S on 16th, and on the morning of 30th the drinking troughs were covered with ice as thick as a shilling ; rain is now much wanted.

**DEANSTON.**—In the early part of the month cold and ungenial, from 16th to 20th hills around covered with S ; corn crops much injured by the worm. In the end of the month, more mild and favorable, and crops improving.

**ABERDEEN.**—A month of cold and (during the first two weeks) wet weather. Vegetation very backward, but still considerably injured by night frosts.

**PORTREE.**—A very cold month, with S and H showers, and keen frost at night, which has retarded vegetation much. Cattle badly off for want of grass.

**LOCHBROOM.**—A very cold and dry month ; grass and cereals very backward ; want of rain much felt ; the end of the month moderately fine weather.

#### IRELAND.

**DARRYNANE ABBEY.**—1st to 8th cold, with N. and N.W. winds, except on 4th, when it was S.W. ; 8th to 19th, easterly winds and cold ; remainder of the month wind variable, but generally from N.W., and warmer weather, especially the last few days. Vegetation very backward in the early part of the month, but progressing rapidly towards the close. The turf (peat) cut for fuel *last* May and June, is only saved and fit for use *now*, in most parts of this neighbourhood, owing to the constant rain of the past year.

**MONKSTOWN.**—Very dry month.

**DOO CASTLE.**—Remarkably fine month ; there was a prevelance of easterly winds, which retarded vegetation ; and pasture ground, meadows, and oats have suffered ; potatoe crops healthy ; peat cutting well attended to this month.

**WARINGTOWN.**—Crops suffering for want of rain, hay will be deficient.

**EDENFELL, OMAGH.**—Although with a fair amount of rain and sunshine, the weather of the month has been unfavorable to vegetation, notably to grass, principally owing to occasional sharp frosts and ungenial northerly winds, otherwise agricultural prospects are encouraging.

# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

XC.]

JULY, 1873.

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### THE THUNDERSTORM AND RAIN OF JUNE 29TH.

Although any individual rainfall cannot be fully treated until all the returns are received at the close of the year, it does not follow that no interim details should be given. The rainfall of June 29th appears to have in almost all cases begun with suddenness, been of considerable intensity, and at isolated stations large in amount. We therefore proceed to submit the following abstract of the returns at present received, grouping them in the order they would occupy in "*British Rainfall*."

*Camden Square.* Slight R began about 4 p.m., but it was heaviest between 5 and 7 p.m., the fall between 6 and 7 p.m. was .40, and between 6.15 and 6.22 .09 fell, being at the rate of .77 per hour; R .69.—*Muswell Hill.* R fell from 4.30 to 7.30 p.m.; R .54.—*Winchmore Hill.* R from 5 to 7.15 p.m.; R .47.

*Croydon* (Addiscombe Road). TS from 4 to 7 p.m., but no R.—*Sevenoaks* (Riverhead Vic.). Half an in. of R fell between 6.15 and 8 p.m.; R .94.—*Chiselhurst* (Heathfield Lodge). R began at 4.15 p.m., with occasional T, R .43.—*Margate* (Acol). R .94.—*Horsham* (Swallowfield). R 1.04.—*Strathfield Turgiss, Winchfield.* Heavy R .90 in. fell in 45 minutes between 4.20 and 5.5 p.m. R, .97 in.—*Newbury.* A vast quantity of R fell in a short time, and in several parts of the town and neighbourhood the roads and houses were flooded. At the Great Western Railway station the rain water washed the approaches, and the booking-offices were flooded several inches deep. No serious damage was done, and the R was greatly needed for the crops.

*Addington, Winslow.* The morning of 29th was warm and bright; ther. 76° in the shade; bar. sinking all morning; overcast towards noon. There was distant T, the wind a point or two East by South. Rain began to fall heavily shortly after 3 p.m.; by 5 p.m. .845 in. had fallen; the weather was fair between 5 and 6 p.m., after which time it rained all the evening. Rain measured at 9 o'clock, Monday morning, 2.645.

*Great Missenden.* R .95.—*Oxford* (Magdalen Coll. Lab.). Distant T and heavy R 3.30 to 9 p.m.; R .85.—*Banbury.* 4 to 5.45 p.m. TS, with heavy R; and again at 7 p.m.; R 1.46.

*To the Editor of the Meteorological Magazine.*

SIR,—A few notes on the rainfall of June 29th and 30th, and the thunderstorms of July 4th, may be of interest, if compared with the fall at other stations :—

June 29th.—2 p.m., sky almost cloudless, hot, light airs from S.E. ; 3.30 p.m., sky clouded ; 4.30 p.m., rain began, continuing at intervals through the night, heaviest from 7 to 9 p.m. ; 4.45 p.m., distant thunder in S. Rainfall to 9 a.m. (30th), 0.32 inch.

June 30th.—Heavy rain, with fresh N.W. wind, from 4 to 5.30 p.m. Rainfall, 0.12 inch.

July 4th.—Two short thunderstorms passed over from S.W. to N.E. at 0.30 and 1.45 a.m. Rainfall during the storms, 0.14 inch ; lightning excessively vivid with loud thunder ; wind S.S.W.

On the previous evening was observed a swarm of gnats, so dense as to obscure the top of a tree. Some weather *savans* hold this to be a sure forerunner of thunder. Is there foundation for this entomological theory ?—Yours truly,

G. WARREN.

*Merton Villa, Cambridge, July 5th, 1873.*

*Sandy (The Lodge). T, R .50.*

*Ipswich.* Distant T, R .92.—*Culford.* No T, but R 1.06 in evening and night.—*Brandon* (W. Tofts). No T, R 1.19.—*Diss.* R began at 7 p.m., R 1.21.—*Norwich* (Sprowston). Slight R from 7, very heavy from 10 p.m. to midnight, ceased at 2 a.m. ; R 1.01.—*Reepham.* R .85.—*Swaffham.* R .48.

*Bridport.* The morning of the 29th was very fine, but sultry ; temp. 75° at 10 a.m. ; at 0.45 p.m. heavy R fell (but without T or L), lasting till 2.30 p.m., temp. at 1 p.m. 70° ; 0.42 in. of R fell, but the R must have been much heavier a mile or two inland.—*Ashburton.* T shower at 0.30 p.m.—*Teignmouth* (Brookbank). R .29.—*Tavistock* (Kilworthy Hill). Heavy R began at 2 p.m. — *Taunton* (The Castle). R .40.—*Burnham.* R .51.

*The Graig, Ross.*—Very warm and sunny till 1.30 p.m., when a thunderstorm came on, not, however, with much electrical display. It continued to rain steadily, at times very fast, till 6 p.m., when 1.54 had fallen, and by 7.20 p.m. another .28 in, making 1.82 in 6 hours.

*Breinton Vicarage, near Hereford.*—The evening of the 28th was fine. Much cirrus had prevailed during the day, except in the district N.N.W., where the sky was perfectly clear. The wind, which had been fresh from W., went down suddenly at sunset. The upper current was very rapid, and was backing towards S.W. The night was sultry, and rather overcast with hazy stratus. Perfectly calm. Minimum temperature, 60°. The morning of the 29th was rather hazy, with a good deal of low dry-looking stratus. I noticed a few cumulostrata above, in the N.W. bar, falling briskly. Breeze rose at 7 a.m. from S, and then backed. About noon, cumulo stratous clouds began to appear, flying very rapidly from S.S.W., and cirrus from S.W. by S., and nimbus began to overspread the sky in the S. and S.W. First



thunder in S.W. by S. at 12.30, but not again until 1.20 p.m. A little rain began at 1 p.m., and the sky became thick all round. Rattling thunder-clap in S.W. at 1.20. The cloud-canopy became slowly thicker and remarkably dark, and the rain increased. Distant, but very frequent, thunder in S. and S.S.E. at 2.40 gradually approaching. The heaviest part of the storm, as far as thunder was concerned, appeared to be to the E. and S.E. The clouds were remarkably wild and gloomy at 4 p.m., the upper current being from S., which cumulus drove rapidly from E.; and there was a gusty north wind on the earth, carrying flying fragments of mist. Nearest lightning to E.,  $1\frac{1}{4}$  miles. This storm travelled from the S., but the thunder did not seem to extend north of this place. The rain continued violent at 5 p.m., but the atmosphere was calmer, and the thunder ceased. At 7 p.m. it cleared very bright in distant S.W., the watery cirrus lying in a long, well-defined arch. In N.E. the sky was very black, while white fragments of low cloud were blowing up from that quarter. Evening cloudy, with much cumulus driving, with a strong breeze from N. by W., but no cirrus above. Temp. max.  $78^{\circ}$  (about 12 o'clock). Afternoon,  $69^{\circ}$ . R fell at Sellack Vicarage, Ross, to the amount of 1.76 in. The storm there was heavy at 3 p.m. The Wye rose 4 ft. at Hereford.—*Wem* (Sansaw Hall). T, R .61.—*Shiffnal*. Fine morning, suddenly overcast at 3 p.m., followed by heavy R rest of the evening; R 1.14 in.—*Market Drayton* (Adderley). R 1.04.—*Buildwas*. R began at 3 p.m.; R .75 in.—*Orleton*. A great and sudden fall of R on the 29th from 1 p.m. to 9 p.m. after a bright and hot morning; R very heavy from 2 to 8 p.m.; T heard at 3 p.m.—*Bromsgrove*. R 1.83, being with two exceptions the largest amount recorded here in 24 hours.—*Droitwich*. On Sunday afternoon and until the following morning the heaviest down fall of R, which has been witnessed by the oldest inhabitant in the borough, occurred here. At the commencement of the storm, and for a continuation of three or four hours, the rain came down in complete sheets of water, deluging the streets in many places, every available watercourse being utterly inadequate to carry off the rapid accumulation of water; many of the first floors of the houses were flooded with the overthrow, carrying with it large quantities of the soil and sand from the streets and roads, the top surface of which was washed so as to have the appearance of pebble pavements. In the neighbourhood some damage has been sustained to the cereal and hay crops, but this fortunately has not occurred to any great extent.

*The Heath House, Cheadle*. 9 a.m. bar. rising ( $29.36$ ); difference between dry and wet bulb  $5^{\circ}$ ; ther. in sun  $113^{\circ}$ ; ther. in shade max.  $74^{\circ}$ ; ther. in shade min.  $53^{\circ}$ ; wind backed from S.W. to S.E.; no indication of R until 2.30 p.m., when heavy watery clouds appeared; at 4 p.m. rain commenced falling very gently, and gradually increased up to 2.30 a.m. (30th), it then ceased until 6.30 a.m., and from then rained fast up to 9.30 a.m.; T was heard in the distance before the rain commenced. but neither T nor L accompanied the R.; rainfall from 4 p.m. on the 29th to 9 a.m. on the 30th, 2.36. *Coventry*. R 1.08.

*Leicester* (Belmont Villas). Heavy T S from 5.30 to 6.30 p.m.; R, 4.30 to 7.0 p.m., 1.00; 7.0 to 10.0 p.m., .30; 10.0 to 9.0 a.m. 30th, .96; total R 2.26.—*Melton Mowbray* (Coston). T at 6.30 p.m.; R .73.—*Mansfield*. R .56.

*Broughton in Furness*. T, R .61.

*Wakefield* (Stanely Vic.). R began at 7.15 p.m.; .48.

*Llanfrechfa*. Violent T S, doing much damage westward; R 1.24.

—*Llandudno*. Fine till 4 p.m. on 29th, then wet till the evening; R 0.30.

From the above it appears that the only localities in which the fall exceeded 2 inches were, Winslow, 2.65; Cheadle, 2.36; and Leicester, 2.26 in. There seem to have been two separate falls, of different character, the first, a thunder-shower, occurring shortly after noon, in Devon and due N. thereof, and travelling Eastwardly at the rate of some 30 miles per hour, until it reached Norfolk about 7 p.m., before reaching which its character of a thunder-shower had vanished, no T being heard in that county. The other falls are local rains of long continuance, but small area, through which mainly the above specified maxima were produced.

### MEASUREMENT OF SNOW.

*To the Editor of the Meteorological Magazine.*

SIR,—In the discussion of this subject in *British Rainfall*, 1872, I notice the following suggestion and comment, "*Make all rain gauge funnels deeper*. We see no objection to this, except the increased surface to be wetted."

May I refer your readers to the reports of my experiments at Hawsker, in the two preceding numbers of the Annual? In that for 1870, Table III., "Form series," we find a 5-inch gauge with 2½ inch upright rim, the funnel and rim being of zinc, with turned brass edge, giving a slight excess in every month over one with an ordinary copper funnel and brass rim; the total from April to December, being 21.362 against 19.935 inches, and 17.917 against 17.535 if rain only is counted. In 1871, a gauge with a rim 6 inches high was used instead, the results being (see Table I.) a total of 21.451 against 21.332 inches from January 1st to October 24th, but a loss of about 1 per cent. during the summer months. There was only one snowstorm in that year, viz., in February. My own opinion is that a gauge with *straight upright rim 3 inches high* will accurately catch 19 out of 20 falls of snow at most of our stations, and will not fail even for the 20th, if during the progress of the fall of the snow be occasionally pressed down into the bottom of the funnel. I have had several such made and used ever since, and I do not think the loss by evaporation from increased surface is appreciable, although occasionally there is a slight difference, owing to such gauges having less dew deposited in them.—I am, Sir, your obedient servant,

F. W. STOW.

*Harpden, Mag 13th, 1873.*

## CYCLONE AND ANTI-CYCLONE.

*To the Editor of the Meteorological Magazine.*

SIR,—Dr. Burder's last letter on the above subject puts the question at issue between us so clearly, that I ought, perhaps, to leave it as it stands for the decision of your readers; but I am tempted to trouble you once more with a few remarks.

I will select two simple and ordinary instances of "anti-cyclones."

I have before me weather-charts for September 21st, 1870, with reports from the stations throughout Europe, Western Asia, North Africa, and the Western shores of the North Atlantic. The centre of an "anti-cyclonic" system, which had been developed on September 15th, and which was maintained until October 7th, then hung precisely over London. The isobars around this described nearly exact circles. The winds were in accordance with what might be expected from the pressure distribution, Stornoway, North Unst, Thorshaven, and the Icelandic stations reporting S. and S.W. currents, the stations up the Norway coast to Fruholmen westerlies, the Swedish north-westerlies, and most of the French, Italian, North African, and Spanish stations N.E. and E. currents. The nearest depressions were:—1st, a shallow one, whose centre occupied Central Russia; and 2nd, a large and intense system, lying over the South of Greenland. No one, I think, will maintain that the circulation of winds then noticeable in the British Isles was due to a cohesion of this mass of atmosphere to masses circulating in an opposite direction, at a distance of 1000 miles, on the cog-wheel principle. A balloon sent up in the S.S.E. current at Liverpool or Holyhead, and carried by the surface-wind, would then have travelled with an inclination to the right for a distance of 1400 English miles, at the least, before falling into a retrograde current and commencing to turn to the left.

For a second instance, I refer your readers to the British Weather Chart for January 27th, 1873, which shows the west border of an anti-cyclone which extended eastwards into Russia. A balloon sent up at one of the French or North German stations, would then have travelled a very long distance before falling into a "cyclonic" current.

I have taken pains to compare the mean relation between the intensity of the central and the exterior portions of "cyclonic" systems with that which prevails between the corresponding portions of "anti-cyclonic" systems, and I can find very little or no difference. In the case of many small, and nearly all, widely-expanded depressions, the area of low gradients and light winds near the centre is of larger diameter than the belts of strong winds and high gradients on the exterior; and the same is the case with areas of elevation.

It is, however, most true that "cyclones" are commonly more intense than "anti-cyclones." I attribute this, 1st, and principally:—to the energetic action of precipitation in the former; 2ndly, to the effects of the inertia of the atmosphere itself, the tangential force always tending to increase the intensity of the "cyclones," and to diminish that of the "anti-cyclones." This, which certainly gives a more active

character to the former systems, is probably also the cause of the greater circularity which they commonly, though not always, possess. It is worthy of remark, that those "anti-cyclones" also which have the steepest gradients have commonly the greatest regularity of form.

There is, indeed, a sense to which Dr. Burder has not referred, in which "anti-cyclones" may be regarded as simply the results of "cyclones." They are fed by upper currents from the latter. This I regard as demonstrable from cirrus observations, and it is, indeed, the only hypothesis on which their maintenance seems intelligible. In this respect, they might be said to have a merely *passive* existence. But, on the other hand, it must be remembered, that the "cyclones" appear to be also maintained by surface-winds from the "anti-cyclones."

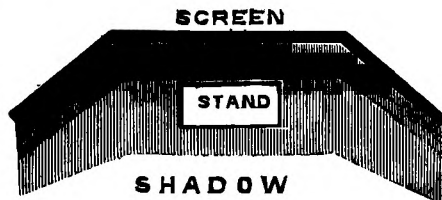
Yours truly,

W. CLEMENT LEY.

### THERMOMETER SCREEN.

*To the Editor of the Meteorological Magazine.*

SIR,—While ruminating this morning upon the correspondence which has, from time to time, appeared in the columns of the *Meteorological Magazine*, with regard to "shade," it has occurred to me that a Glaisher stand placed in the middle of an open lawn is exposed (in summer) to an undue amount of heat, consequent upon the intensity with which the solar rays strike, not only the stand itself, but the ground immediately surrounding it. After a long "spell" of dry weather, the soil becomes as hot as a furnace, proved by the number of fissures on its surface, and the parched appearance of the vegetation which grows upon it. To obviate this difficulty, I propose to erect a wooden hoarding several feet behind the stand, and (say) eight or ten feet in height, in the shadow of which the stand will, of course, be placed; and I shall be glad to hear your opinion, and those of your readers, upon the merits and demerits of this proposal. The annexed rough ground-plan illustrates my meaning perhaps more forcibly:—



I remain, Sir, faithfully yours,

E. G. ALDRIDGE.

P.S.—Perhaps hurdles, covered thickly with gorse or heather, would be better than the hoarding.

24, Guildford Street, W.C., 29th June, 1873.

# WATERSPOUTS NEAR DUNMOW.

*To the Editor of the Meteorological Magazine.*

DEAR SIR,—Though not myself a witness of what I refer to below, I think that you will be interested to hear that on Thursday, June 5th, "waterspouts" were seen by several persons in this neighbourhood. They appeared between 2 and 3 p.m., and, as well as I can make out, must have passed to the S.W. of this place, and in a direction from N.W. to S.E. The first person who called my attention to this was my own servant. On my return home, about 6 p.m., he stated that he had noticed a strange cloud, with a point towards the ground. And on my showing him a picture of a waterspout in an old book, "*The 100 Wonders of the World*," he at once recognised it as like what he had seen. His brother was coming home with a waggon, about 3 miles north-west of this (direct), when a sudden fall of water wetted him through before he could get under the tilt of the waggon. Other men have mentioned seeing 3 or 4 of these curious shaped clouds. In one place the water could be seen from a distance pouring down. I heard it remarked, by more than one person, that the water in the streams had run quite thick and muddy after the rain. Here, and in Dunmow, where I happened to be, there was a steady rain, but nothing extraordinary. Total R 0.18 inch.

The newspapers report that a waterspout was seen on the same day, about 6 p.m., from Shepton Mallet, in the direction of the Bristol Channel.—Yours truly,

EDWARD MAXWELL.

*High Roding Rectory, Dunmow, Essex, 10th June, 1873.*

## REVIEWS.

*La Seine, Études Hydrologiques, Régime de la Pluie, des Sources, de Eaux Courantes. Applications à l'Agriculture, par M. BELGRAND, Membre de l'Institut, Inspecteur Général des Ponts et Chaussées, &c.*  
Paris: Dunod. 1 thick vol. royal 8vo. and folio atlas of plates.

TRULY this is a splendid illustration of the occasional truth of the saying, "They do these things better in France." We have often had the pleasure of calling attention to excellent papers in the *Annales* of the *Corps des Ponts et Chaussées*, but the above work by M. Belgrand, Inspector General of the Department, is one which has few (if any) equals in any language. Although written with a different object, it possesses many points of resemblance to the *Report on the Physics and Hydraulics of the Mississippi*, by Capt. Humphreys and Lieut. Abbot, which, so far as we know, is the only work which can challenge comparison with the present publication.

We were much surprised to see that upon the first page of the preface, the author describes the term "hydrologiques" as a *new* word, whereas Beardmore's work, published in 1862, under the title of

"Manual of Hydrology," sufficiently indicated the long anterior use of its English equivalent. It is impossible, without largely drawing upon our space, to give more than a general sketch of the contents of this handsome volume. The work is divided into two parts: the first treats of the physical geography and geology of the basin of the Seine, its rainfall,\* and the relation between the depth of rain and the volume of the floods thereby produced. Then the author discusses the mode by which the water passes to its destination, by traversing permeable strata to form springs, and by filling the streams and rivers; and after classifying the various affluents of the Seine, he gives for each stream, and for many stations on each, particulars the completeness of which will be realized by the fact that details similar to the following are given for some hundred stations.

Designation of source—*Springs of Briant.*

Locality and river into which they flow—*Near Brunoy, in the valley of the Yères.*

Importance of the source—*A large spring.*

Temperature of the water— $53^{\circ}2$ .

Titre } *Pour tous les sels de chaux et de magnésie.*— $23.50$   
Hydrotimétrique } *Pour les sulfates seulement.*—*Considerable.*

REMARKS.—*There are at the bottom of the Yères Valley many springs which yield water abundant, in quantity and of good quality, but unfortunately at too low a level to be available for the supply of Paris.*

The analysis of water for drinking purposes is in England carried to such a degree of refinement as to puzzle all but those who specially devote themselves to the subject, with, moreover, the not very remarkable result that different reports of the same water are given by different analysts. It appears that in the work before us attention is almost wholly given to the hardness of the waters, and none to the amount of organic impurity which they contain.

In the above quoted particulars of the water from the Brunoy springs we gave the analytical remarks untranslated, because we are not acquainted with the "Hydrotimètre" by which they are determined. It is thus described by M. Belgrand:—

"The hydrotimeter is an instrument now too well known to need description, my own researches having perhaps not a little contributed to familiarise its use throughout France. According to Messrs. Bontron and Boudet, who have introduced among us this very simple mode of analysis, one hydrotimetric degree indicates that a cubic metre of the water experimented upon contains sufficient earthy salts to neutralise a hectogramme of ordinary soap. The Grenelle water, varying from  $9\frac{1}{2}^{\circ}$  to  $12^{\circ}$ , neutralises nearly one kilogramme of soap per cubic metre. The water of the Seine, which marks from  $18^{\circ}$  to  $20^{\circ}$ , two kilogrammes; that of the Ource, which gives from  $30^{\circ}$  to  $34^{\circ}$ , three kilogrammes; and the Arcueil, which marks nearly  $40^{\circ}$ , from  $3\frac{1}{2}$  to 4 kilogrammes."

From the above it seems that the hydrotimeter is the French equivalent of the English "soap test," and that hydrotimetric degrees correspond to, and are convertible into, the English "degrees of hardness." We should be greatly indebted to any of our Continental

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\* The rainfall observations in the basin of the Seine are now under the direction of M. Georges Lemoine, and we believe most efficiently worked.

friends who would favour us with a description and, if necessary, drawings of the instrument, for we are sure that simple means for testing drinking water (a development in fact of Danchell's pocket apparatus) are required, and that they should be in the hands of every medical man who holds the appointment of Health officer.

We must pass a very interesting chapter relating to the circumstances which regulate the deposit of carbonate of lime by waters which hold it in solution, commending it to the careful consideration of all engineers who are obliged to use water largely charged therewith. The next subject discussed is the "Springs which may be led to Paris." This is partially of local interest, but contains many useful hints, *e.g.* :

*Temperature of the water of the Dhuis.*—The aqueduct of the Dhuis is 81 miles long. Many persons have thought that in this great length the water would lose its freshness. The following tables prove that the greatest changes of temperature in the transit from the springs at Pargny to Paris are unimportant. [Tables are then given showing the temperature at Pargny and at the Ménilmontant reservoir each day during 1867, 1868 and 1869.] We see at once, by mere inspection of these tables, that during these three years the temperature of the Dhuis water, on its arrival at Ménilmontant reservoir (that is to say, after a journey of 81 miles in the aqueduct), has not been higher than  $56^{\circ}\cdot7$  (August, 1867), nor lower than  $45^{\circ}\cdot1$  (December, 1867). The maximum has always occurred in August, and ranged between  $54^{\circ}\cdot7$  and  $56^{\circ}\cdot7$ ; the minimum has occurred either in December or January, and ranged between  $45^{\circ}\cdot1$  and  $47^{\circ}\cdot8$ . At the springs at Pargny the range is only from  $49^{\circ}\cdot5$  to  $51^{\circ}\cdot3$ .

In subsequent chapters M. Belgrand traces, more fully than we believe any one has ever before done, the course of water falling on different geological formations, tracing the relative surface and subsoil flow, and the relative number of streams per square kilometre in every variety of permeable and impermeable strata. This is followed by a discussion of the records obtained by the following system :—

"By virtue of a ministerial decree of February 3rd, 1854, regular observations are made of the state of the Seine and its affluents. We record especially the variation in the flow of each stream, and with this object gaugings are now taken at 37 stations; at ordinary times, when the rivers are in their usual state, observations are taken once a day; but when they are in flood, gaugings are taken every three hours. The values are entered on a form which is sent to Paris at the end of each month."\*

Comparisons of summer and winter floods; details of all the important ones for several hundred years; a coloured plan showing the portions of Paris submerged by the floods of 1658, 1740 and 1802; remarks on the means by which Paris can be completely protected from floods, are followed by equally full details of droughts and by an exhaustive analysis of the discharging capacity of the various bridges, wherein the mischief produced by some few, which afford insufficient water way, is clearly shown.

The chapters on the influence of forests on rainfall, or rather on the flow from certain districts, on the navigation, including particulars of

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\* Frequent reference is made to the serious loss which the department sustained by the destruction of nearly all its records, which were in the Hotel de Ville when it was burnt during the Commune. We find in the above account no reference to duplicates being kept by the observers, but doubt not that this obvious precaution is now taken.

the various works constructed for its benefit, the lengths, altitudes, locks, &c. of the various canals, and the traffic upon them, on running water considered as motive power, are much to the point; as indeed are all the subsequent ones which deal chiefly with the filtration of water (M. Belgrand points out clearly the imperfections of the English method) and with the relation of the precedent facts to agricultural matters.

With reference to the atlas of plates, we need only say they are worthy of the author, and of the text.

We have noticed this work at unusual length, on account of its great excellence, and because throughout we have had before us, with constant pressure for an answer, the question—Why have we not a similar work on the chief of English Rivers?

Parliament, we believe, some years back placed the control of the river in the hands of a body of gentlemen representing the interests of navigation, commerce, crown property, the corporation of London and riparian proprietors. Science was of course not considered worthy of a representative, though happily there was elected (on other grounds) perhaps the very person whom of all others one would have chosen for his intimate acquaintance with the hydrology of the Thames. Although this body (the Thames Conservancy) might not easily find one man with the wide range of attainments of M. Belgrand, there could be no difficulty in obtaining the co-operation of a group of men each of whom in his own province has few superiors. M. Belgrand's *La Seine* is an honour to himself and to his country; we should be glad to say the same of a work on the Thames.

*Relazione tra le variazioni diurne della Elettività atmosferica a ciel sereno e quelle del Barometro Nota, del PROF. DOMENICO RAGONA, Direttore del R. Osservatorio di Modena.—Modena, 1873, 11 pages, 8vo.*

IN this pamphlet Prof. Ragona offers some remarks upon the note by Dr. Jelinek in the *Zeitschrift* for March 1st, 1873, respecting Prof. Ragona's previous paper upon another branch of this subject. The author seems to consider that a distinct connection is established between the hourly variation in the amount of atmospheric electricity, and the oscillations of the barometer, and quotes Quetelet's *Météorologie de la Belgique* (1867) and Duprez *Sur l'Électricité aérienne*, as well as the observations of Kew, Utrecht, and Melbourne, in support of his views. He will, however, doubtless be glad to know that he will find stronger and more complete evidence in Kaempts's *Meteorology* (either the German, French, or English edition), and better still in the paper in the *Phil. Trans.* of the Royal Society of London, by Prof. Everett, upon "Results of Observations of Atmospheric Electricity at Kew Observatory and King's College, Windsor, Nova Scotia,"—the latter being a very careful paper, well illustrated, and giving charts of the hourly changes in the amount of atmospheric electricity.



It augurs well for an author, when evidence of which he is not aware, is brought forward in support of the views he has enunciated. At the same time, we cannot help asking, if there is anything surprising in the fact of this relation? Would it not be more remarkable if the curves of (say) pressure and electricity did not agree than if they did? Both are produced by the one great cause of all diurnal atmospheric changes—the earth's rotation on its axis—and although we can readily understand that there may be occasional exceptions, we should be at a loss to explain systematic discordance between two of the effects of one cause.

*L'Umidità, lettura del PROF. D. RAGONA, direttore del R. Osservatorio di Modena* Milan: Fratelli Treves. Post 8vo, 52 pages.

WRITTEN in an essentially popular style, this pamphlet contains a complete resumé of the hygrometric observations made at Modena, during the years 1864 to 1871, from which we have compiled the following abstract:—

TENSION.						HUMIDITY (Saturation = 100)				
YEAR.	Mean.	MAX.		MIN.		Mean.	MAX.		MIN.	
		Amnt.	Date Year	Amnt.	Date Year		Amnt.	Date Year	Amnt.	Date Year
Jan. ...	·183	·311	31 1866	·078	30 1868	86·1	100	several times.	30	30 1868
Feb. ...	·208	·340	12 1866	·050	8 1870	80·6	100	several times.	13	22 1870
March.	·223	·375	13 1867	·055	5 1869	72·5	100	20 1865	13	20 1872
April..	·281	·491	30 1866	·057	9 1867	60·7	97	several times.	7	9 1867
May ...	·383	·657	29 1869	·100	1 1871	60·7	97	25 1866	14	2 1871
June...	·439	·725	28 1868	·140	28 1871	59·9	95	6 1868	16	28 1871
July ...	·484	·754	10 1869	·204	12 1871	52·7	94	15 1868	12	20 1866
Aug...	·480	·825	16 1868	·155	5 1865	58·7	95	29 1867	16	5 1865
Sept ...	·437	·678	24 1867	·136	8 1870	63·1	98	20 1868	15	8 1870
Oct. ...	·324	·662	3 1868	·090	27 1869	73·5	100	27 1865	17	2 1871
Nov....	·249	·439	4 1865	·089	17 1866	82·1	100	several times.	24	5 1869
Dec. ...	·207	·357	5 1865	·097	31 1869	84·4	100	several times.	31	13 1867
Totals	·325	·551	...	·104	..	69·6	98·0	...	17·3	...

The extreme dryness occasionally reached will immediately attract the attention of English observers; that the humidity should be below 20 in nine months out of twelve is a remarkable fact, surpassed only

by the record for April 9th, 1867, of a humidity of 7. As in this country it seldom falls below 33, one has difficulty in realising the dessicating effects of a reduction to 7. Even Prof. Ragona regarded it as "so extraordinary a phenomenon," that he published a separate notice of its occurrence.

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*Seven Years' Meteorology of Sidmouth, 1865-1871*, by J. I. MACKENZIE, M.B. Cantab, M.R.C.S., &c.—[From Trans. Dev. Ass.] 8vo. 12 pages.

ANOTHER of Dr. Mackenzie's carefully compiled papers on the climate of Sidmouth, bringing up the information to the close of 1871. It is satisfactory in every respect but one, and having said that, it will be readily understood that in raising *one* objection, we by no means condemn the paper, quite the contrary, the paper is a thoroughly good one. On page 7 Dr. Mackenzie gives an elaborate table containing some 200 or 300 entries, of which we doubt the utility. It is headed "Barometric Range 1865-1871," and gives for each month of each year the highest and lowest reading of the barometer, and the differences between those values. It will facilitate discussion should our views be thought erroneous if we number our objections. (1) There is nothing to show whether the values are, as indicated by the use of the term "barometer reading" uncorrected, or whether they are sea level pressures. (2) If the former, they are absolutely valueless, being unaccompanied by the readings of the attached thermometer. (3) If the latter, their value is extremely small, because neither the date nor hour of their occurrence is given. (4) We are not aware that Dr. Mackenzie possesses a self-recording barometer, and without it, much self-denial and unexampled patience are requisite to secure records of the extremes of each month. Here we may appropriately raise a question, which, like many of the others, affects nearly all British publications, and not Dr. Mackenzie's alone. The point is (5) one of insufficient definition. We do not think records of barometric range are comparable, because (a) the true barometric range is the difference between the *absolute* maximum and *absolute* minimum corrected reading, which by (4) we have shewn to be difficult of observation, (b) with many, if not most observers, "barometric range" is merely the difference between the greatest and least *observed* heights, (c) with others it is merely the difference between the extremes at the regular hour or hours of observation. (d) Now it is evident that *b* and *c* will both be less than the truth, and that their approximation thereto depends partly upon the frequency of observations, and partly upon the chance accordance of the extremes with the times of observation, and therefore we hold that, with the exception of the values published by the Meteorological Office, and those of the Royal Observatory, all records of barometric range in this country are delusive and incomparable. Lastly (6) we should be glad

to know the object contemplated by the determination of the amount of barometric range.

Should our views be correct, and should our criticism of the present want of uniformity lead to improvements or to its abandonment, Dr. Mackenzie will unintentionally have added one more to the many benefits which directly and indirectly he has conferred upon local climatology.

*Presidential Address*, by A. BUCHAN, M.A., F.R.S.E. [Trans. Botanical Society of Edinburgh.] 8vo, 15 pages.

DEVOTED mainly to tracing the interdependence of Meteorology and Botany, this paper concludes with the excellent suggestion that local Natural History Societies might render good service by preparing local maps, recording *precisely* the spots in which various plants are found, and upon other impressions from the same maps preparing charts illustrative of the physical geography of the district.

*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.* 8vo, 72 pages. Oxford: Parker, 1872.

WE admit that this work, like too many others, has been for some months waiting notice, but the date appended to the Introduction is June 15th, 1872, or two years and a half after the last observation contained in it was made. If the work were a new one, or one of which the matter changed from year to year, this great delay would be less remarkable, but far from that being the case, much of the matter is identical from year to year, and might, with economy and advantage, be either stereotyped, or omitted.

Having a tower 105 feet high, the Radcliffe Observatory has special facilities for comparing the temperature of the stratum of air at that height with that 4 feet above the ground, and it is distressing to find so excellent an opportunity frittered away by the use of a Six's thermometer, which being (page 29) between 1° and 2° in error, is altogether unworthy of a richly endowed University establishment.

*On the Optics of Mirage*, by PROFESSOR EVERETT, M.A., D.C.L., Queen's College, Belfast. [Phil. Mag., March 1873.] 8vo, 12 pages.

THE title of this paper at once stamps its precise character. Professor Everett devotes the early part of it to determining the path of rays through air of various densities and temperatures, and then proceeds to apply the results of the mathematical investigation of the problem to the several varieties of mirage which have been observed, and which he groups with his usual exactness and lucidity.

JUNE, 1873.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						TEMPERATURE.				No. of Nights below 82°	
		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.			
I.	ENGLAND.	Camden Town .....	2·24	— ·81	·69	29	11	79·2	22	42·3	7	0	0
II.		Maidstone (Linton Park) .....	3·70	— ·96	·86	18	13	84·0	29	44·0	1, 26	...	...
III.		Selborne (The Wakes) .....	1·53	— 1·70	·29	4	11	76·0	22	38·5	4	0	0
IV.		Hitchen .....	1·68	— ·96	·37	4	16	75·0	21	39·0	6	0	...
V.		Banbury .....	3·68	+ ·40	1·46	29	12	78·0	29	40·0	14	...	...
VI.		Bury St. Edmunds (Culford) .....	2·50	— ·08	1·06	29	10	80·0	22	37·0	6	0	0
VII.		Bridport .....	1·76	— 1·48	·45	12	10	75·0	29	41·0	15	...	...
VIII.		Barnstaple .....	1·50	— 2·62	·63	29	11	73·0	7*	44·0	1	...	...
IX.		Bodmin .....	2·34	— 1·70	·68	11	14	69·0	30	47·0	16	0	0
X.		Cirencester .....	2·21	— 1·17	·58	29	13	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall) .....	2·61	— ·50	1·14	29	13	76·0	21	43·0	4	0	...	
XII.	Tenbury (Orleton) .....	2·78	— ·74	1·49	29	12	78·7	21	38·8	4, 8	0	0	
XIII.	Leicester (Wigston) .....	4·06	+ 1·30	1·61	29	10	84·0	29	40·0	6	...	...	
XIV.	Boston .....	2·13	— ·06	·98	29	8	82·0	21	41·0	2	...	...	
XV.	Grimsby (Killingholme) .....	1·34	— ...	·26	14	14	74·0	21†	43·0	2	...	...	
XVI.	Derby .....	2·21	— ·68	1·36	29	9	78·0	21	43·0	2	0	...	
XVII.	Manchester .....	2·97	— ·37	1·37	3	12	80·6	29	43·0	14	0	...	
XVIII.	York .....	...	...	...	...	...	...	...	...	...	...	...	
XIX.	Skipton (Arncliffe) .....	2·53	— 1·57	·46	24	21	75·0	8	37·0	15	...	...	
XX.	North Shields .....	1·43	— 1·31	·26	15	10	...	...	...	...	...	...	
XXI.	Borrowdale (Seathwaite) .....	7·78	— 2·73	1·90	27	12	...	...	...	...	...	...	
XXII.	WALES.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	
XXIII.		Haverfordwest .....	2·11	— 1·87	·80	10	11	71·0	17	40·0	4	...	...
XXIV.		Rhayader (Cefnfaes) .....	1·95	— ·34	·60	30	15	75·0	...	37·0	...	...	...
XXV.		Llandudno .....	·60	— 1·69	·30	29	7	78·0	21	46·0	14	...	...
XXVI.		Dumfries .....	1·90	— 1·00	·35	4	15	72·5	5	40·0	16	...	...
XXVII.		Hawick (Silverbut Hall) .....	1·52	— ...	·50	3	14	...	...	...	...	...	...
XXVIII.		Kilmarnock (Annanhill) .....	...	...	...	...	...	...	...	...	...	...	...
XXIX.		Castle Toward .....	2·39	— 1·10	·50	22	12	77·0	5	...	...	...	...
XXX.		Leven (Nookton) .....	1·39	— ·85	·37	13	15	75·0	20	40·0	1	0	3
XXXI.		Stirling (Deanston) .....	2·06	— ·86	·26	21	19	72·3	5	34·3	1	0	1
XXXII.	SCOTLAND.	Logierait .....	1·40	— ...	·41	14	13	74·0	20	40·0	22	...	...
XXXIII.		Braemar .....	2·83	— ·61	·71	14	15	68·8	2	32·7	1	0	2
XXXIV.		Aberdeen .....	1·01	— ...	·25	13	15	79·5	21	42·9	12	0	0
XXXV.		Inverness (Culloden) .....	1·45	— ·47	·76	14	18	66·9	22	44·2	1	0	0
XXXVI.		Portree .....	5·90	+ 1·12	1·27	27	18	...	...	...	...	...	...
XXXVII.		Loch Broom .....	2·49	— ...	·54	13	14	...	...	...	...	...	...
XXXVIII.		Helmsdale .....	2·13	— ...	·40	23	16	...	...	...	...	...	...
XXXIX.		Sandwick .....	1·82	+ ·28	·28	27	13	68·1	2	36·9	1	0	1
XL.		Caherciveen Darrynane Abbey .....	2·99	— ...	·49	3	20	...	...	...	...	...	...
XLI.		Cork .....	2·43	— ...	·52	18	9	...	...	...	...	...	...
XLII.	IRELAND.	Waterford .....	1·44	— 1·55	·42	18	10	74·0	8	45·0	7, 16	...	...
XLIII.		Killaloe .....	2·91	— ·72	·43	23	17	79·0	21	40·0	16	...	...
XLIV.		Portarlinton .....	1·47	— 1·78	·48	12	18	77·0	21	43·0	1	...	...
XLV.		Monkstown .....	·48	— 2·13	·15	29	11	...	...	...	...	...	...
XLVI.		Galway .....	3·54	— ...	·52	3	21	71·0	2, 7	45·0	15	0	...
XLVII.		Bunninadden (Doo Castle) .....	1·39	— ...	...	...	...	...	...	...	...	...	...
XLVIII.		Waringstown .....	1·58	— ...	·32	14	11	88·5?	30	42·5	16	...	...
XLIX.		Edenfell (Omagh) .....	2·14	— ...	·50	21	20	71·0	21	36·0	15	...	...

\*And 18, 21. +And 22.

+ 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.—T on 4th, 18th and 29th; first 20 days mostly dull, with frequent heavy rain, then a few dry but not hot days, with rain again on 29th and 30th; so that vegetation, which was late at the beginning of the month, still continues so, wheat not being generally in ear till 27th; winds various; bar. highest on the 21st. Taken on the whole it has been more favourable than May, still there has been little that can be called summer weather.

SELBORNE.—Wind very variable; fog on 3rd, 4th (dense), 5th, and 6th; TS at 4 p.m. on 5th; T at 9 p.m. on 22nd; difference between max. and min. on 6th only 7°, and on 22nd 20°.

BANBURY.—TS with H on 3rd; heavy R (1.25) on 4th; TS with .43 of R on 13th; and TS with heavy R from 4 to 5.45 p.m.; and again at 7 p.m. on the 29th, causing the max. fall of the month to be 1.46.

CULFORD.—The month has passed without T being heard here, but a heavy rainfall was experienced in this neighbourhood in the evening and night of the 29th, amounting to 1.06, the heaviest fall in the month.

BRIDPORT.—TS on 2nd, 5th and 29th; the morning of the 29th was very fine, but sultry, the ther. being 75° at 10 a.m.; at 0.45 p.m. heavy R fell (but without T or L), lasting till 2.30 p.m., temp. at 1 p.m. being 70°; 0.42 in. of R fell, but the R must have been very heavy a mile or two inland.

BODMIN.—Bar. average during the month 30.01; average temp. 59.3; rainfall considerably below the average.

SHIFFNAL.—The month, although cold during the first half, was free from frost and favourable for vegetation; TS on 3rd, at 3.30 p.m. in S.E.; on the 21st it became warmer, the max. reaching 76°; on 29th, after a cloudless morning, it suddenly became overcast at 3 p.m., followed by heavy R the rest of the evening, making the greatest fall of the month—1.14 in. The wind was in E. or N.E. during the first week, when it changed to N., and varied from that to W. and S.W. till the close of the month.

ORLETON.—The sky generally clouded and very little sunshine, but the temp., even though low; a great and sudden fall of rain on the 29th from 1.30 p.m. to 9 p.m. after a bright and hot morning, R very heavy from 2 to 8 p.m., distant T heard at 3 p.m.; T heard on the 3rd, 7th, 12th, 13th, 14th, 15th, and 29th; L seen on 3rd; rough winds frequent during the month; all the crops later than usual, wheat only coming into ear at the end of the month.

WIGSTON.—The mean temp. of the month was about the average of a number of years; corn looking very healthy but thin and backward; vegetation unusually luxuriant; T and H on 3rd; T on 13th, and max. fall 1.61 on 29th.

BOSTON.—Gooseberries very plentiful on 22nd; wheat in ear on 22nd, hay being cut on 24th; and strawberries ripe on 26th.

GRIMSBY.—Cold up to the 8th, then warmer; max. temp. 74° on 21st and 22nd. Wheat in ear on 25th; wild roses began to flower on 26th.

MANCHESTER.—1.37 (max. of month) during a TS on 3rd, the whole in two hours; TS on 18th and 28th.

ARNcliffe.—A cloudy month, with small rainfall, and yet it fell on 21 days; TS on 13th.

NORTH SHIELDS.—T on 8th; laburnum in flower on 3rd; white and purple lilac on 4th; globe ranunculus on 8th; double narcissus on 11th; grass iris on 14th; and St. Bernard's lily on 15th.

## WALES.

HAVERFORDWEST.—The month commenced cold and cloudy, with N.E. winds; throughout it was damp, at times very wet; very sultry the third week, temp. however below the average, reaching 70° on two days only. A fine month for vegetation; every prospect of good hay and corn.

**CEFNFAES.**—The month an ungenial one, cold and damp, the hills generally covered with thick haze and mist; wind N.E. and S.W.

**LLANDUDNO.**—At 10 p.m. on 2nd a heavy T shower; on 3rd, at 11 a.m. a TS, and another slight one at 5.30 p.m.; fine till 4 p.m. on 29th, then wet till 8 p.m.; 0.30 fell, which was the max. of the month, only about the same quantity having fallen during the preceding 28 days; began to cut hay on 13th; month dry, with much sunshine.

#### SCOTLAND.

**DUMFRIES.**—The first three weeks warm, with occasional showers; towards the end of the month alternate sunshine and showers; the rainfall 1.90 is 3.70 in. below that of June 1872; the mean temp. was 58°.4, or nearly 3° higher than last June; T on 4th, 12th and 26th; the crops in this locality looking remarkably fine, but potatoes rather later than for two years past.

**HAWICK.**—A dry month with cold easterly winds prevailing; T on the 10th, but it brought no rain; hay crop thin, and the corn fields densely yellow with ketlocks or mustard; a good soaking rain very much needed.

**CASTLE TOWARD.**—A fine month for putting in turnips and carrying on outdoor labour of all sorts; turnips in this quarter got in, and thinning going on vigorously; from 21st to the end of the month having such a heavy fall of rain has caused grass pastures and every other thing to be luxuriant; every appearance of good fruit crops; potatoes look well and free from disease; sheep and cattle healthy, and no appearance of foot and mouth disease; on the whole June being a fine month for all classes.

**DEANSTON.**—A good month; in the latter part somewhat broken and wet; crops of all sorts looking well and growing rapidly.

**BRAEMAR.**—TS on 17th, and T with rain at 5.30 p.m. on 4th.

**ABERDEEN.**—A month of fine warm dry weather, but fogs rather prevalent; rainfall and barometer pressure below the average, temperature above it, and wind pressures about the average.

**PORTREE.**—More frost than usual in June; the end of the month wet and squally.

**LOCHBROOM.**—The first eleven days very dry and cold, then for 4 days heavy falls of rain, then dry till the 21st, and thence we had not a dry day during the month; finer weather for turnip sowing we never had, and the latter rain has made the grass grow up, to the graziers and sheep farmers' entire satisfaction.

**SANDWICK.**—The latter part of May, as well as the first part of June, was very dry, but from 20th to 27th of June there was copious rain and mild weather, very favourable to vegetation; on the 22nd there was a TS from 1 to 2 p.m., with heavy rain.

#### IRELAND.

**DARRYNANE.**—Early part showery, with principally N.W. winds; T on 3rd, and heavy T on 5th; latter part of the month foggy with westerly winds, with very rapid vegetation; potato blight showing slightly during the last 10 days.

**WATERFORD.**—The long continuance of dry weather has greatly retarded the growth of the grass, and the hay will be very light; on high lands the grass is quite withered and burnt up.

**MONKSTOWN.**—Total rainfall for past three months, April 0.62, May 0.67, June 0.48. Average for the last 10 years, April 1.59 + 0.97, May 1.89 + 1.22, June 1.49 + 1.01., Total + 3.20.

**DOO CASTLE.**—Remarkable for drought and a prevalence of wind; farmers complain of short meadows, and the oat crop it is feared will be also short; fuel got up in abundance.

**WARINGSTOWN.**—The weather in this month has been generally bright, and the showers have improved the crops very much.

**OMAGH.**—Very seasonable; all crops promise an abundant harvest.

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XCI.]

AUGUST, 1873.

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## THE HEAT AND THUNDERSTORMS OF JULY 22ND.

Temperatures exceeding 90° in the shade, are infrequent in this country, and therefore their occurrence is worthy of chronicle and of study. Moreover, they are almost always followed by violent electrical phenomena, and it is the duty of meteorologists, not merely to record what occurs, but to endeavour to trace out cause and effect.

On the present occasion, we confine our remarks to the temperature in the shade on the 22nd.

In the first place, we give a few extracts to show the exceptional character of the temperature observed :—

*Harpenden.*—During the last few days we have had great heat. Maximum, 350 ft. and 4 ft. above ground, July 21st 84°, 22nd 86°·2, 23rd 82°·5; 380 ft., 4 ft. above ground (J. Wilson, Esq.), 21st 83°·5, 22nd 85°, 23rd 83°; 420 ft. 4 ft. above ground, 21st 83°·5, 22nd 85°, 23rd 80°; 434 ft. 18 ft. above ground, 21st 82°, 22nd 83°; 23rd 79°. All thermometers in louvre board screens, and *not* exposed to heat radiated or reflected from ground. A maximum in first named screen exposed to this registered 85°·5, 87°·6, 84°·5 on the three days.—F. W. STOW, M.A., F.M.S.

*Clifton.*—During 21 years the temperature has only reached 90° four times, viz. : 1856, Aug. 2, = 91°·4; 1868, Aug. 4, = 90°·2; 1870, July 24, = 91°·3; and 1873, July 22, = 90°·9.—G. F. BURDER, M.D.

*Bath.*—The temperature on July 22nd in a Stevenson's stand was 90°·2, being the highest recorded during 25 years.—C. S. BARTER, M.D.

*Heaton Chapel.*—Since 1863 the temperature has exceeded 90° only on the following days :—1866, June 27th, 90°·9; 1868, July 15th, 91°·1; and Aug. 4th, 91°·8; 1869, July 17th, 92°·1, and August 28th, 91°·1; 1873, July 22nd, 91°·9.—J. CURTIS, F.M.S.

*Trevalyn Hall, Wrexham.*—The temperature on July 22nd, 91°·6, is the highest I have recorded since observations were commenced in 1865.—B. T. GRIFFITH.

*Cargen, Kirkcudbright.*—The temperature on 22nd is the highest ever observed here.—P. DUDGEON.

Secondly, inasmuch as the halcyon days of uniform thermometer stands are not yet come, we may give for a few hot days in July, 1872, the results of the Strathfield Experimental Thermometers. They are expressed as differences from the record of the maximum in the Kew Thermometer Stand :—

Date.	Kew.	James.	Stow No. 2	Martin.	Stevenson.	Glaisher.	Morris.	Griffith.
July 5	80.3	+3.7	+4.6	+0.8	-4.0	+4.7	-4.9	+3.9
6	83.3	+2.7	+2.9	0.0	-4.7	+3.7	-6.9	+2.9
21	84.4	+3.2	+ .6	+1.3	-4.8	+1.4	-7.1	+2.5
25	85.7	+2.8	+ .5	+1.3	-4.4	+2.3	-5.2	+3.3
Mean..	83.3	+3.1	+2.2	+0.9	-4.5	+3.0	-6.0	+3.2

These differences are extremely large, and, perhaps, for certain reasons, which we cannot stop to explain, rather too large, but they sufficiently show that in the ordinary grounds of an English Rectory, it follows that if the observer uses the form of stand employed at Greenwich, he will on a day of great heat record a temperature of  $7\frac{1}{2}^{\circ}$  hotter than if he used one of those recommended by the Scottish Meteorological Society.

Such a fact would dishearten many from an attempt to deal with questions of temperature, until such anarchy is a thing of the past. There are, however, generally two ways of viewing a question, and it must not be forgotten (1) that it would be fatal to all comparison of past, with present or future weather, if the old stands were abandoned without comparison with whatever new pattern may be adopted; and (2) that as there is no regularity in the "geographical distribution" of different patterns of thermometer stands, it is probable that the variations produced by their faulty construction will be neutralised by the presence of different patterns in the same neighbourhood.

Acting under these considerations, we have drawn up the following table:—

*Maxima in the British Isles, July 21st-23rd, 1873.*

Station.	21st.	22nd.	23rd.	Station.	21st.	22nd.	23rd.
Camden Sq., London (g)	88.0	90.1	86.6	Tavistock .....	92.0	...	...
Pinner Hill .....	...	82.0	...	Barnstaple .....	...	...	90.0
Winchmore Hill (g) .....	90.0	91.9	88.0	Trevarrick, St. Austell ..	...	74.8	...
Croydon (g) .....	84.9	87.0	84.5	Taunton .....	...	91.0	...
Surbiton (g) ..	92.6	93.2	86.1	Bath (s) .....	...	90.2	...
Linton Park, Maidstone...	...	92.0	...	Clifton, Gloucester .....	...	90.9	...
Bromley, Kent .....	...	85.0	...	Upfield, Stroud .....	...	88.0	...
Eltham, „ (P) ..	89.3	90.8	89.0	Haughton Hall, Shifnal...	78.0	84.0	...
Roy. Obs., Greenwich (g)	86.5	88.7	87.2	Sansaw Hall, Salop ..	...	87.5	...
Selborne, Hants .....	79.0	82.2	...	Cheadle ..	...	...	85.0
Hitchin .....	...	79.0	...	Orleton, Worcester .....	84.5	89.6	...
Addington, Bucks .....	...	87.0	...	Bromsgrove .....	...	83.8	...
Banbury .....	...	88.0	...	Oscott, Birmingham .....	...	77.1	...
Oxford .....	...	89.0	...	Wigston, Leicester .....	...	92.0	...
Wisbech .....	86.2	88.3	88.4	Belmont Villas, Leicester	86.7	91.7	82.5
Bury St. Edmunds .....	...	...	86.0	Horncastle .....	...	85.0	...
Diss .....	...	83.0	...	Calcethorpe, Brigg .....	...	89.0	...
Sprowston, Norfolk .....	...	...	92.0	Grimsby .....	80.0	...	80.0
Coston, Norwich .....	...	83.8	...	Mansfield .....	88.0	...	...
Hillington, Lynn .....	87.3	87.3	86.0	Derby .....	...	88.0	...
Bridport .....	...	84.0	...	Buxton, Derbyshire (g)...	83.0	88.0	79.0
Ashburton, Devon .....	...	82.0	...	Macclesfield .....	...	90.0	...



Station.	21st.	22nd.	23rd.	Station.	21st.	22nd.	23rd.
Old Trafford, Manchester ...	...	95.0	...	Llandudno .....	...	93.0	...
Heaton Chapel, Lancashire ...	86.3	91.9	76.9				
Parsonage, Garstang (P) ...	..	92.6	...	SCOTLAND.			
Broughton-in-Furness ...	85.0	...	...	Cargen, Kirkcudbright ...	...	87.1	...
Stanley, Wakefield .....	82.0	89.0	...	Dumfries .....	...	84.0	...
Halifax .....	...	88.3	...	Melrose, Roxburgh .....	...	87.0	...
York .....	...	85.5	...	Annanhill, Kilmarnock ...	...	81.2	...
Arncliffe .....	...	87.0	...	Nookton, Fife .....	...	83.0	...
North Shields .....	...	...	75.6	Logierait, Perth .....	...	89.0	...
Elterwater, Ambleside. ....	...	86.0	...	Dundee .....	82.0	...	...
Surbiton .....	92.6	93.2	86.1	Aberdeen .....	80.4	81.0	...
Harpenden .....	84.0	86.2	82.5				
„ .....	83.5	85.0	83.0	IRELAND.			
„ .....	83.5	85.0	80.0	Waterford .....	...	76.0	...
„ .....	82.0	83.3	79.0	Killaloe, Clare .....	83.0	...	...
„ .....	85.5	87.6	84.5	Portarlinton ...	...	78.0	...
WALES.				Black Rock, Dublin .....	84.0 on 20th.	...	...
Llanfrechfa, Monmouth ...	...	84.0	...	Monkstown, „ ..	„	...	...
Haverfordwest .....	..	83.6	...	Twyford, Westmeath .....	„	73.0	73.0
Cefnfaes, Radnor .....	...	92.0	...	Galway .....	..	80.0	...
Wrexham .....	...	91.6	...	Waringstown, Down ...	...	...	83.0
				Edenfell, Tyrone .....	76.0	..	...

N.B.—(e) Glaisher's stand. (P) Pastorelli's stand. (s) Stevenson's stand.

Unless for known error we have, in compiling this table, rejected no returns, there are, however, some which differ very widely from their neighbours ; but considering the variation due to stands, and the, in some respects, capricious distribution of temperature during the period, we leave all records unsifted, and resting on the responsibility of the various observers. As an illustration of the care required in any such process of sifting, we may instance the recorded maximum at North Shields, 75°·6 on 23rd ; looking merely at the context, many people would think the true maximum must have been nearly 8° higher and one day earlier. Irrespective, however, of reliance on our excellent correspondent, we have the confirmatory evidence of a second observer, who reports the maximum for the 22nd as 72°.

The first feature which requires notice is the prevalence of the maximum on the 22nd at the great majority of stations ; with, however, some subsidiary indications of an easterly progression in its occurrence on the 20th on the Irish Coast, on 22nd generally, but on the 23rd on the Norfolk, Lincolnshire, and Northumbrian coasts.

Then, with respect to the distribution of temperature on 22nd, we notice that there is great general agreement among the records, that with scarcely an exception the maximum at coast stations was under 80° ; at stations not more than 10 miles inland, 85° ; and at all places further inland, between 85° and 95°. Temperatures exceeding 90° seem to be confined to—(1) Middlesex and West Kent, (2) Somerset and South Gloucester, (3) Leicester, Cheshire, and Lancashire, (4) Central and N.E. Wales.

Some idea of the effect of this temperature may be gained from the

statement of one of our correspondents that on that one day twelve persons were killed by sunstroke.

We hope in our next to be able to discuss the thunderstorms which followed this heat, and in which we are told by the same authority, ten persons were killed by lightning.

### METEOROLOGY IN DENMARK.

ONE by one each civilized nation is establishing, under some title or other, a Meteorological Department, and it is well that thus it should be. Considering the general feelings of our countrymen, the status of the two principal Meteorological Societies, and, above all, the band of trained observers in the British Isles, there was, probably, no country which needed such an establishment less than we did. If, therefore, it was wise for the British Government to devote £10,000 or £15,000 per annum to such a purpose, it necessarily follows that it is still more wise of other nations to establish offices with endowments proportional to their area and national prosperity.

Although for some reasons we regret that the pressure on our space has prevented our earlier referring to the welcome intelligence of the establishment of the Danish Meteorological Institute, under the direction of Captain Hoffmeyer, there is the advantage that now we can judge of the organization by work done, instead of merely by promises made.

For its size Denmark has, for nearly half a century, contributed a fair quota to the general store of meteorological statistics. The Copenhagen record goes back, we believe, to 1822; three or four other stations were started in 1846, and others between 1848 and 1852. Moreover, between 1849 and 1859, perhaps the longest series of comparative evaporation experiments yet published, were made at Emdrup.

In 1861 the Royal Danish Agricultural Society organized a series of stations, in order to ascertain the relative climate of various parts of the country, and the results have been published annually since that time.

In the autumn of 1872, the Danish Government resolved upon the establishment, under the auspices of a Special Committee, of the Danish Meteorological Institute, charging it with the supervision of all branches of Meteorology, but specially with the establishment of telegraphic Meteorological stations throughout Denmark, both for Danish purposes and for interchange with the rest of Europe. Moreover, arrangements were contemplated, and are now far advanced, for the establishment of six stations, in the Faroe Isles, in Iceland, and in Greenland, respecting which every one will agree with, and approve, the following remarks by Captain Hoffmeyer:—

“Outre l'intérêt général que présenteront ces stations, elles pourront à une époque prochaine devenir d'une grande importance pour la météorologie internationale et la prévision du temps par la submersion éventuelle d'un cable télégraphique par cette voie de l'Europe à l'Amérique du Nord. Les observations de ces stations seront publiées explicitement.”

The mention of Iceland reminds us of a Danish meteorological publication which quite supports our previous remarks on the good position in Meteorology long held by Denmark, and of which it may, perhaps, be convenient to some of our readers to be informed. The work in question\* gives an unbroken series of observations for 15 years in the early part of the present century, including for the greater part of that time the pressure, highest and lowest temperature of the air, temperature of the sea, depth of rain, direction of wind and state of weather for each day, printed *in extenso*, with abstracts and discussions. We have, however, on the present occasion to deal with the present rather than the past, with recent publications and arrangements rather than with those of a third of a century back.

We have already mentioned that the Royal Danish Agricultural Society established a series of stations in 1861. This Society has now published† an abstract of the results obtained during their supervision, and, having done so, they have transferred all the documents to the new office, and will, we presume, in future confine their attention to agricultural matters. We hope that this not the case, for (except perhaps in Bavaria) there is no country or society in Europe devoted to the study of the mutual interdependence of agriculture and climate, and the Danish Society seem to have done so well that which they undertook to do, that we should have been glad to have seen the connexion perpetuated. However, in any case, they are entitled to the thanks of meteorologists for their past services, and for enabling the new Institute to start with the support of previous records.

It would be inexpedient for us to remark in detail on the contents of this pamphlet; suffice it to say, that it is a very useful compilation, and gives almost all the information which can be desired; not quite all, we believe, for after more than one search we are unable to find the total rainfall in each year at each individual station. Various tables are given, but the only one which would inform us of the relative rainfall of various parts of the country being omitted, we are obliged to content ourselves with converting, and placing before our readers, the average (at an irregular number of stations) rainfall over the whole country:—

*Average Rainfall in Denmark, 1861—1870.*

Year.	Amount. In.	Year.	Amount. In.
1861 ... ..	24·89	1866 ... ..	29·44
2 ... ..	24·98	7 ... ..	26·95
3 ... ..	24·20	8 ... ..	24·63
4 ... ..	21·63	9 ... ..	22·23
1865 ... ..	17·68	1870 ... ..	20·94
Mean 10 years ... ..		23·76	
,, 50 years at Copenhagen		23·09	

\* *Observationes Meteorologicae a 1 Jan. 1823, ad. 1 Aug. 1837 in Islandia factae a Thorstensenio, Medico.* Hafniæ 1839.

† *Femaarsberetning fra det Kongelige Landhusholdningsfeltsabs Meteorologiske Committee for 1866—1870.* BED POUL LA COUR. Copenhagen: Schultz, 1872.

It will be noticed that these figures present a very similar progression to those representing the rainfall fluctuations in England; the wettest year being in both countries 1866, but the driest was 1864 in the British Isles, and 1865 in Denmark.

The observations reduced in this work have been made with perseverance worthy of a more complete equipment than the stations appear to have possessed, and with the not infrequent result of determining some elements better than where though the apparatus is more elaborate, there is less zeal.

Lastly, we have briefly to refer to the publications of the new Institute. These are issued with exemplary promptitude. We have already (July 26th) received the monthly packet of observations for June printed *in extenso*. The tables issued by the Institute are arranged to contain tri-daily observations (8 a.m., 2 p.m., 9 p.m.) of the following elements, (1) barometer at 32°; (2) temperature; (3) elastic force of vapour; (4) relative humidity; (5) direction and force of wind; (6) amount of cloud; (7) weather. In addition to which is given (8) maximum and minimum temperature; (9) amount of rain; (10) temperature of the sea. The sheets received are for the month of June, from what may be called the Home stations of Skagen, Ringkjöbing, Fanö, Samsö, Bogö, and Hammershus, and for April and May, from Thorshaven, in the Faroe Isles.

### EXTRAORDINARY FLASH OF LIGHTNING.

*To the Editor of the Meteorological Magazine.*

SIR,—A very remarkable flash of lightning occurred here on July 16th. The morning was showery, and thunder-clouds formed in different directions at 9 a.m. About 10 a large cumulus rose in W.S.W., and broke in rain about 5 miles from this place, its summit at the same time, as is usual in incipient storms, assuming the cirriform appearance. The first thunder-clap soon followed, and was succeeded by seven or eight others as the storm travelled to N.W. The sky overhead was quite clear, and also over Hereford, 3 miles east of this place, and the storm-cloud had a very isolated appearance, though there were other distant clouds on the horizon. I was standing in my garden watching the distant lightning, when a flash left the cloud 2 or 3 miles to W.N.W. of this place, passed almost directly overhead, but a little to N.E., and descended upon Hereford, traversing in a horizontal direction a space of about five miles of clear blue sky, devoid of cloud. The clap commenced nearly in the zenith, the time interval showing the part of the flash nearest to this place to be about  $1\frac{1}{2}$  miles; it then became loud both over Hereford, in the east, and in the storm, in the west. Hereford lies comparatively low, and the electric fluid travelled near the earth over high ground covered with trees, buildings, &c.; avoided All Saints' and St. Peter's spires, very near which it must have passed, and singled out a house in the more eastern part of the city. The house struck is lower than others in the same row, and the adjoining

house on the west has much higher chimneys. Not much injury was done, though two persons suffered from a temporary paralysis. The inhabitants of Hereford, few of whom had noticed the distant storm, were greatly startled by the terrific flash and clap under a clear sky and brilliant sun.

As observed here, the flash appeared straight, almost resembling a rocket fired horizontally, but Mr. Isbell informs me that as seen in Hereford it was very zigzag, and seemed to come along near the ground.

I sent you last summer an account of several similar flashes, which passed in succession out of a thunder-cloud west of this place. Once before, in April, 1865, I was watching from Sellack Vicarage, near Ross, a violent storm fully six miles distant, the sky overhead being almost perfectly clear, when I was astonished by a tremendous flash of lightning at a distance of about 500 yards. These are the only examples of lightning striking the earth at a distance from a storm which I have myself observed in the course of about twenty years, during which I have minutely watched every thunder-storm in my neighbourhood; but there are records of occasional accidents from lightning at the distance of one or two miles from a thunder-storm.

The ancients, as school boys know, regarded such occurrences as portents of evil omen.—Yours truly,

W. CLEMENT LEY.

*Breinton, Hereford, August 5th, 1873.*

#### RAINFALL OF JULY 13TH.

Although the total amount on this day was not excessively large, the following details respecting its progress are of sufficient interest to merit insertion:—

*Muswell Hill.*—Fall of R in 24 hours ending at 9 a.m., 14th, 1·24, a greater fall than I have recorded in this or last year, of this 1·12 fell between 10.30 a.m. and 10 p.m. on 13th.

*Winchmore Hill.*—On 13th, R commenced at 10.30<sup>1</sup>/<sub>2</sub> a.m., and continued till 3.15 p.m., when 1·09 had fallen, ·70 of which fell between 1.30 and 3.15 p.m.. Heavy showers afterwards made the total in 24 hours 1·25. A heavy gale from the S. from 3 to 7 p.m., doing much damage. A large chesnut tree snapped off a few feet from the ground during a heavy squall about 4 p.m.

*Culverlands, Farnham.*—On 13th, R 1·72, of which 1·42 fell between 10.30 a.m. and 3 p.m.

*Morehill, Shedfield, Fareham.*—On 13th, R began about 9 a.m., and up to 2.30 p.m. 1·50 had fallen. Slight showers afterwards made the total for the day 1·67. Gale in after part of the day.

*Berkhampstead.*—On 13th the large amount of 1.69 fell between 10 a.m. and 8 p.m. It fell heavily from 11 a.m. to 3 p.m. (1·10), then gently till 7, when it again fell heavily, and ceased at 8, adding ·59. There was neither T or L, and but little wind. So heavy a fall has not been recorded here since 2<sup>nd</sup> of October, 1857, when 2·65 was collected in the 24 hours.

*Harpenden.*—13th. An apparently cyclonic storm with very heavy rain commencing about 11 a.m., and becoming heavy by noon. The wind was exceedingly strong during the afternoon, coming in violent squalls most unusual in summer. The following amounts were recorded by my electrical gauge at the anemometer station (415 feet) and 3 feet above ground, opposite to which I have placed those observed at my house (350):—

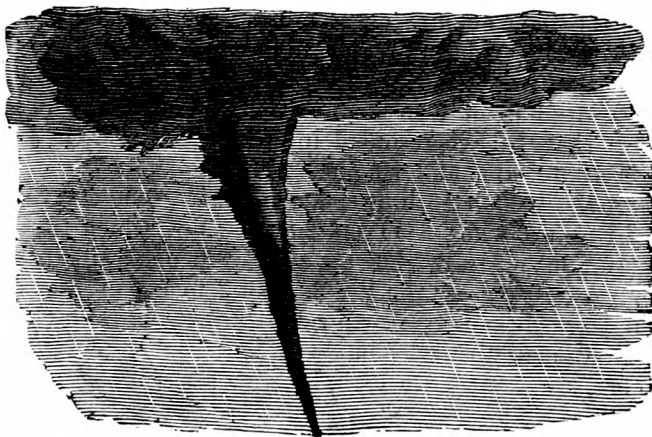
	Electrical Gauge 415 feet.				Harpenden 350 feet.		Velocity of wind by Anemometer.
	Total.	In each hour.			Total inches.		Miles.
Up to noon	·07	.....	·07	.....	—	.....	15
1 p.m.	·30	.....	·23	.....	·37	.....	10
2 p.m.	·75	.....	·45	.....	·77	.....	11
3 p.m.	·86	.....	·11	.....	·95	.....	32
4 p.m.	1·01	.....	·15	.....	—	.....	21
5 p.m.	1·22	.....	·21	.....	1·32	.....	28
6 p.m.	1·32	.....	·10	.....	1·40	.....	31
7 p.m.	1·39	.....	·07	.....	—	.....	33
8 p.m.	1·49	.....	·10	.....	1·61	.....	27
11 p.m.	1·50	.....	·01	.....	1·62	.....	17

F. W. STOW.

### WATERSPOUT AT MANCHESTER.

*To the Editor of the Meteorological Magazine.*

SIR,—Enclosed I send a sketch, in the rough, of a waterspout I saw on Saturday, the 26th:—



This peculiar cloud appeared at 3.15 p.m. in the E.S.E. The lower tapering part appeared to wave about, and apparently had a spiral motion. The appearance was that accompanying a waterspout. There was rain at the time, and indication of electrical disturbance. You will see further particulars in the enclosed extract from the *Manchester Guardian*:—

A WATERSPOUT IN MANCHESTER.—On Saturday afternoon a phenomenon which is frequently noticed at sea, but is very rare on land, was witnessed on the

southern side of Manchester. About four o'clock a heavy black cloud drifted slowly up before the wind, and from its edge, which was at that moment over Alexandra Park, a column, in the shape of an inverted cone, began to form, and descended towards the earth. The upper part of the column was considerably agitated, and the mass rapidly grew in length and density until the end hung suspended, apparently not more than 150 feet from the ground. The spectacle was exceedingly singular. At the moment when the spectators were expecting the "spout" to burst the wind increased and a violent rain fell, in the midst of which the threatening appearance of the cloud gradually disappeared, and in a quarter of an hour the long waving pillar of cloud lost its previously well-defined shape and became merged in the surrounding masses of vapour.

Very truly yours,

G. V. VERNON.

*Old Trafford, Manchester, July 28th, 1873.*

## RAIN GAUGES IN TROPICAL COUNTRIES.

*To the Editor of the Meteorological Magazine.*

SIR,—Will you allow me to suggest for the consideration of manufacturers and those who may contemplate at any time taking rain gauges into hot climates that the metallic gauges generally supplied are not advisable for that purpose.

It frequently occurs that when a smart shower falls, while the greater part, of course, falls into the receiver, a considerable amount collects on the funnel, then sunshine succeeding, it does not take long to evaporate this, while, especially if, as in Messrs. Negretti's 8 inch gauge, the receiver take the form of a cup, a great quantity is evaporated from within, and again condensed on either the convex side of the funnel, or the inside of the gauge itself, in either case defying measurement. This occurring often, must destroy to a considerable extent the value of the returns.

It seems to me that the best material for a gauge in hot climates is white glazed earthenware, or porcelain; the whole vessel to act as receiver without any smaller one inside.

A day or two ago (24th) we had a rainfall (I believe unprecedented for this locality) of *ten inches* in the twenty-four hours. The consequence was that my rain gauge (N. & Z.'s 8 inch) was on the point of overflowing, and a quarter of an hour's more rain would have entirely destroyed my observation. This, however, might not happen again for a long time, but still, I would point out the fact that in a tropical climate where, in addition to extreme heat, there are many light casual storms which admit of measurement, and also at times an extremely heavy diurnal rainfall, rain-gauges should be made of a material which should be affected to the least possible degree by the sun's rays, and capable in point of size of holding the greatest daily fall in any country. I think this might be done at a small cost, but of that I leave others who are better qualified to judge to decide.—I am, Sir, yours obediently,

T. FELTON FAULKNER, F.M.S.

*St. Thomas' College, Colombo, Ceylon, May 26th, 1873.*

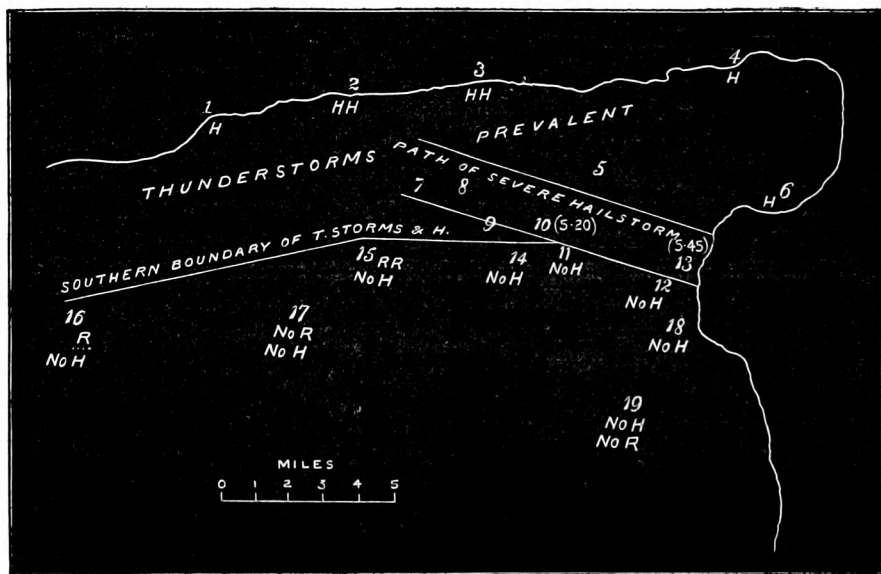
## HAILSTORM IN EAST KENT.

*To the Editor of the Meteorological Magazine.*

SIR,—I enclose a paper showing (as far as data allow) the path of the severe hail storm in Kent, on July 15th, between 5 and 6 p.m. It seems to me that the opposing forces of the winds were very equally balanced, if the *regular* width of the hail storm ( $1\frac{1}{2}$  miles) during a course of ten miles be their result. The surface current over Kent was S.W., the hail clouds coming over in W.N.W. current. The speed is very clearly shown from Stourmouth to Salterns to have been 1 mile in 5 minutes. The severity of the hail was about equal at all places; the size of the larger stones varied from  $1\frac{1}{2}$  to  $2\frac{3}{4}$  inches (circumference); at some stations irregular in shape, at others quite spherical. No rain was mixed with the hail at Stourmouth and Salterns. It is remarkable that no discharge of electricity took place from the hail cloud after the coast line was reached, though the hail was fully as heavy up to the shore. The duration of the storm was alike, or nearly so, at all the stations (about 10 minutes). Corn and fruit were much injured, and greenhouses suffered severely. At 6.15 to 6.30 a violent thunderstorm was bursting about midway between Reculvers and Margate, the lightning being intensely vivid and frequent.

I am, yours truly,

G. WARREN.

*Merton Villa, Cambridge, August 6th, 1873.*

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- |              |                |               |
|--------------|----------------|---------------|
| 1 Whitstable | 8 Chislett     | 14 Preston    |
| 2 Herne Bay  | 9 Grove Ferry  | 15 Sturry     |
| 3 Reculvers  | 10 Stourmouth  | 16 Selling    |
| 4 Margate    | 11 West Marsh  | 17 Canterbury |
| 5 Monkton    | 12 Richborough | 18 Sandwich   |
| 6 Ramsgate   | 13 Salterns    | 19 Eastry     |
| 7 Hoath      |                |               |



JULY, 1873.

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.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.				
				Dpth	Date.			Deg.	Date.	Deg.	Date.	
		inches.	inches.	in.			Deg.	Date.	Deg.	Date.	In shade	On grass.
I.	Camden Town .....	1.81	+ .02	.97	13	12	90.1	22	45.8	19	0	0
II.	Maidstone (Linton Park).....	1.60	— .38	.74	13	9	92.0	22	46.0	15	...	...
III.	Selborne (The Wakes).....	3.48	+ 1.28	2.16	13	13	82.2	22	41.0	29	0	0
IV.	Hitchin .....	1.99	+ .09	1.24	13	10	79.0	22	44.0	5, 18	0	...
V.	Banbury .....	2.48	+ .42	.73	13	15	88.0	22	43.5	29	...	...
VI.	Bury St. Edmunds (Culford).....	2.23	+ .24	.77	13	9	86.0	23	43.0	4, 18	0	0
VII.	Bridport .....	1.61	— .50	.48	13	12	84.0	22	42.0	19	...	...
VIII.	Barnstaple.....	4.49	+ 1.63	.74	3	20	90.0	23	44.5	8	...	...
IX.	Bodmin .....	4.23	+ 1.12	.81	24	19	78.0	27	49.0	16	0	0
X.	Cirencester .....	2.94	+ .50	.80	13	14	...	...	...	...	...	...
XI.	Shiffnal (Haughton Hall) ...	2.73	+ .56	.83	3	16	84.0	22	45.0	13	0	...
XII.	Tenbury (Orleton) .....	2.63	+ .25	.85	3	17	89.6	22	40.2	19	0	0
XIII.	Leicester (Wigston) .....	2.34	+ .24	.59	13	14	92.0	22	42.0	18	...	...
XIV.	Boston .....	2.25	— .05	1.15	13	11	90.0	23	43.0	19	...	...
XV.	Grimsby (Killingholme) .....	2.97	...	1.06	3	15	80.0	21†	47.0	5, 19	...	...
XVI.	Derby.....	2.14	— .05	.51	13	15	88.0	22	46.0	8	0	...
XVII.	Manchester .....	4.65	+ 1.96	.77	3	18	95.0	22	45.5	14	0	...
XVIII.	York .....	1.74	— .20	.61	13	13	85.5	22	46.5	5	...	...
XIX.	Skipton (Arncliffe) .....	5.47	+ 2.24	1.23	3	20	87.0	22	38.0	4	...	...
XX.	North Shields .....	2.27	+ .46	.45	25	16	75.6	23	46.2	5	...	...
XXI.	Borrowdale (Seathwaite).....	16.96	+ 8.82	2.90	2	20	...	...	...	...	...	...
XXII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest .....	4.23	+ .93	.60	2	20	83.6	22	48.0	4, 14	...	...
XXIV.	Rhayader (Cefnfaes).....	3.78	+ .93	1.00	27	22	92.0	22	43.0	...	...	...
XXV.	Llandudno.....	2.28	— .01	1.11	25	15	93.0	22	48.4	14	...	...
XXVI.	Dumfries .....	6.08	+ 3.83	1.30	30	25	84.0	22	42.5	5	...	...
XXVII.	Hawick (Silverbut Hall).....	4.06	...	.92	25	15	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill).....	5.81	...	1.42	17	26	81.2	22	41.1	5	...	...
XXIX.	Castle Toward .....	5.36	+ 2.22	.77	31	16	79.0	22	...	...	...	...
XXX.	Leven (Nookton) .....	3.62	+ 1.35	.83	17	21	83.0	22	41.0	4	0	0
XXXI.	Stirling (Deanston) .....	...	...	...	...	...	...	...	...	...	...	...
XXXII.	Logierait .....	4.06	...	.56	4	19	89.0	22	42.0	14	...	...
XXXIII.	Braemar .....	4.21	+ 1.93	.50	3	23	79.5	22	35.8	15	0	1
XXXIV.	Aberdeen .....	3.97	...	.66	13	19	81.0	22	41.1	15	0	0
XXXV.	Inverness (Culloden) .....	3.50	+ .83	1.06	28	16	74.6	21	47.0	15	0	0
XXXVI.	Portree .....	5.83	— .24	.53	19*	26	...	...	...	...	...	...
XXXVII.	Loch Broom .....	3.54	...	.45	22	23	...	...	...	...	...	...
XXXVIII.	Helmsdale .....	4.44	...	1.07	27	20	...	...	...	...	...	...
XXXIX.	Sandwick .....	2.39	+ .50	.48	22	18	75.3	22	44.9	13	0	0
XL.	Caherciveen DarrynaneAbbey	6.07	...	1.10	28	29	...	...	...	...	...	...
XLI.	Cork .....	3.40	...	.73	13	15	...	...	...	...	...	...
XLII.	Waterford .....	3.73	+ .41	.54	24	22	76.0	22	47.0	13	...	...
XLIII.	Killaloe .....	4.17	+ .98	.59	17	20	83.0	21	43.0	15	...	...
XLIV.	Portarlinton .....	3.17	— .37	.34	13	27	78.0	22	44.0	13	...	...
XLV.	Monkstown .....	3.86	+ 1.43	1.95	22	20	84.0	20	...	...	...	...
XLVI.	Galway .....	6.47	...	.68	28	24	80.0	22	45.0	13†	0	...
XLVII.	Bunninadden (Doo Castle) ...	4.23	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown .....	5.32	...	.99	22	27	83.0	23	42.0	16	...	...
XLIX.	Edenfell (Omagh).....	4.43	...	.80	24	27	76.0	21	41.0	4	...	...

\*And 29. †And 23. ‡And 17.

+ 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.—Second half of month warm, dry, and fine, the hottest days being the 21st, 22nd, and 23rd; very little T; brisk wind and heavy rain on 13th; winds all from S., S.W., and W., not any from N. or N.E., which is very unusual here. On the whole a favourable month; vegetation making much progress, and the harvest not likely to be as late as was at one time expected.

SELBORNE.—13th high wind and heavy rain from 9 a.m. to 7 p.m.—2.16; 15th short storm of R and H, with T and L at 12.30 p.m. on 15th; a very dry month if you eliminate the 13th; weather very oppressive from 19th to 26th.

BANBURY.—23rd, from 3.40 to 4.10 a.m. TS; T again at 6 a.m.

CULFORD.—T on 3rd, 4th, 14th, 15th, and 18th. That on the 15th (St. Swithin's) was accompanied by H and R; S.E. winds on 12, and S.W. on 19 days.

BRIDPORT.—There has been a prevalence of S.W. gales and windy days; no calm sea during the month. On 22nd a heavy TS began about 8 p.m., lasting to 2 a.m. on 23rd, the L was bluish, and flashes more frequent than I have seen before, mostly sheet but some forked. Within 6 miles there was much damage done, and some gentlemen in a yacht, trying to make for Lyme Regis, were caught in the centre of the storm, wind blowing in gusts from N.W. to S.W., and so dark they could not see their hands when close to their faces, the L was fearful and the rain so heavy that they were as wet in two minutes as if they had plunged into the water. The boatman said he had never seen anything to equal it.

BODMIN.—Average of Bar. 29.98; average Temp. 62°·3.

HAUGHTON HALL, SHIFFNAL.—With the exception of the 20th, 21st, and 22nd, when the max. suddenly reached 79°, 78°, and 84° respectively, the month has been by no means hot; on the 22nd it was intensely so, but distant T ensued, in S at 7 p.m., with slight rain, and next day the temperature fell to 74°, T also on the 4th and 18th. Although the frequent rainfall was trying for haymaking, none was much injured, while the crops of grain were much benefitted, and the swedes and mangolds thoroughly established. Wind throughout ranged from W. to S.W.; remarkably few butterflies of all sorts, even of white ones; and as yet but few wasps.

ORLETON.—A fine month for vegetation, with a low temperature, but generally steady; a great prevalence of cloud, and but few sunny days till the 20th, then bright sunshine and great heat, on that day the ther. rose to 79°·7 in the shade (fully protected); on the 21st it reached 84°·5 with sky nearly cloudless; at 9 a.m. it stood at 78° on 22nd, and at 1 p.m. it reached 89°·6, with bright sunshine and few cumulus clouds; after 3 p.m. great piles of T clouds passed over from S. to N., forming at 6.30 p.m. grand masses in the N., with several peals of distant T, Ther. at this time being 85°, and 9 p.m. 70°, the min. of following night was 63°·5 in the shade; on the morning of the 23rd distant T and L passed across to the E. between 3 and 4 a.m., with a very slight fall of rain, followed by a bright day and brisk wind, ther. reaching 80° about noon; the remainder of the month was the same in character as the beginning, but rather warmer.

WIGSTON.—A fine month, which has improved the corn surprisingly, and with the many showers which have fallen the pastures have been good in many situations; 21st and 22nd were oppressively hot.

BOSTON.—TS on 3rd, 13th, 14th, and 16th.

GRIMSBY.—TS on 12th, 14th, 15th, 22nd, and 30th. A fine month, corn crops greatly improved; all kitchen and garden produce abundant.

ARNcliffe.—Violent TS at 8.30 a.m. on 23rd; weather very variable, difficult haymaking—as we call it here, kittle; 21st, 22nd, 23rd, and 24th very sultry; 1.20 fell in 4 hours on the 2nd during TS.

## WALES.

NORTH SHIELDS.—TS on 12th, 14th, 15th, and 23rd; L on 22nd.

HAVERFORDWEST.—Constant rain, no heavy rain, but unfortunate for haymaking; temperature very cool for July, exceeding 70° on 7 days only; great heat from 21st to 23rd, which terminated in a TS of moderate violence; from

23rd to the end of the month it was constantly damp, sultry, and rainy, the nights were all, with three exceptions, warm; plenty of grass, and the corn looking very well. Health of this locality excellent.

RHAYADER.—Temperature low for the season, and damp; much T and L, slight showers very frequent; prevailing winds S.W. and S.E.

LLANDUDNO.—T on 4th at 10.15 a.m., on 22nd from 4 to 5.30 p.m., and on 23rd at 2 a.m. On 22nd the day was very hot, the greatest heat being about 1 p.m., 93°, when there was a difference of nearly 20° between the wet and dry bulbs; at 4 p.m. a TS of unusual severity commenced in S.E., and gradually approached Llandudno as it travelled westward. The T became almost incessant till 5.30; the L was mostly forked with some very vivid flashes; R set in about 5, and was very heavy for about 10 minutes, a good many hail (or rather ice) stones fell with the rain, they were very transparent and all one shape, viz., circular and double convex, resembling both in size and shape the confection known as "acid drops"; about 5.30 when the storm had nearly cleared away, I noticed that the dry bulb stood at 73°, and the wet about 4° lower, but though the temperature was thus 20° lower than at 1 p.m., the air felt really warmer and more oppressive, which I attributed to its comparative excess of moisture. During the night another storm occurred, which, though not so severe, was still peculiar: a dark cloud hung over the sea, the L behind which, at every flash, so illuminated it, that it had the appearance of a transparent white sheet, the T was loud, but not so incessant as the storm of the preceding afternoon.

#### SCOTLAND.

DUMFRIES.—This has been the wettest month of July, that has occurred here for more than 25 years, the rainfall for the month is 3.39 above the average of the preceding five years. Extraordinary TS on evening of 22nd and morning of 23rd; T on 26th; the country looking very fresh and beautiful, but cereal crops now require dry weather.

HAWICK.—A fine, warm, genial month; terrific TS on the night of 22nd, nothing like it ever before seen here. Crops looking well, splendid crops of gooseberries, strawberries and currants.

ANNANHILL, AYR.—Several severe TSS over the county, but none were felt here. On the night of the 22nd-23rd, a severe TS took place, which was general over the island, doing much damage in many places. Haymaking was general by the middle of the month, and finished by the end, the crop rather light; a considerable quantity of potatoes raised by the 19th, quality good; oats and wheat much improved, as are crops of all kinds. The harvest commenced early in S. Ayrshire. A field of oats cut on 28th; potatoes and bulbs of all kinds good as yet, the prospect of wall fruit rather small; berries of all kinds plentiful; shrubs of all kinds looking well. Ozone well developed, but in no case exceeding the maximum (11). Sky was usually half covered with clouds; severe TS on 27th over South Ayrshire. Country generally free from cattle disease. Death rate at Kilmarnock, only at the rate of 23 in a 1,000 per annum; consumption heading the list.

CASTLE TOWARD.—The crops have made great progress, the hay is mostly cut except in the high lying districts, the crop is said to be light except in meadows. In fields unaffected or slightly affected by the grub, there is some prospect of a good harvest. Potatoes promising well, but within the few days back disease has commenced. In several districts round here the fruit crop is above the average; small fruits, gooseberries, strawberries, currants, &c. very plentiful, and the large fruits with the exception perhaps of plums are not far behind. Cattle and sheep healthy and pasturage in abundance.

LOGIERAIT.—Severe TS commenced about 9 p.m. on 22nd, in the S., towards midnight it travelled westward, and raged with great violence from 11.30 to 1 a.m. (on 23rd) flashes very frequent and at times the sky presented the appearance of a brilliant Aurora; about 5 a.m. the storm began a new and lasted for more than an hour and a half, at this time being much nearer, heavy R fell from 6 to 7 a.m. The heat was very great from the 21st to the 24th, the mean of those 4 days being 83.8, the highest reached was 89° on the 22nd; the temp. has greatly cooled since the 24th; the rainfall was general and heavy throughout the month; the hay

crop when not secured has been considerably damaged. A few peals of T on the 27th.

BRAEMAR.—T heard on 14th, 22nd, 27th, and 28th; the T on 22nd continued from 4 p.m. on 22nd to 2 a.m. on 23rd, with very vivid sheet L.

ABERDEEN.—Rainfall, temp., and prevalence of S.W. wind above the average, bar. and pressure of wind below it. A month of warm and rather wet weather; remarkable TS on the night of 22nd and morning of 23rd, perhaps more correctly TSS as there appeared to be three, 11 p.m. to 1.30 a.m., 2 a.m. to 4 a.m. and 6.30 to 9 a.m., but there was distant T and L all through the intervals.

PORTREE.—A very wet and squally month, but notwithstanding all this, the crops are doing well, but the harvest will be late. No blight as yet in the potatoes. The TS of the 22nd did not reach this island.

LOCHBROOM.—A very wet month, propitious for growing crops, but detrimental to hay-making. On 21st and 22nd the heat was very oppressive; about midnight on the 22nd, the most severe TS I ever remember, continuing for three hours; no damage done in this district, but a man and horse were killed not far from here.

SANDWICK.—13th, T about 1 p.m.; 14th, about 10 peals of T at noon and at 5 p.m.; 22nd, severe TS, sheet and forked L from 7 to 9 p.m.; 23rd, TS during the past night, and till 10 a.m. July has been 2° warmer than the mean; the R has also been in excess; the weather generally pleasant and favourable to vegetation; but on the 13th and 14th we had TSS, on the latter day a waterspout is reported to have burst a few miles distant, H and large pieces of ice fell; again on 22nd there was one of the most severe TS we have had for some years, by which two sheep were killed.

#### I R E L A N D.

DERRYNANE ABBEY.—Wind almost constantly W. during the month, heavy E (1.10) on 28th; potatoe stalks nearly all destroyed by blight, but tubers pretty sound yet.

WATERFORD.—Gale of wind W. on 4th, and strong wind on 7th S.

MONKSTOWN.—Severe TS from 1.30 to 3 a.m. on 23rd, accompanied by heavy E, which continued 4 hours, during which time 1.95 in. fell. A very showery month.

DOO CASTLE.—A wet month, which has benefitted grass meadows, and oats. Potatoe blight very perceptible but the tubers not affected.

WARINGTOWN.—Heavy showers with T and L. The crops in general very good.

OMAGH.—Weather humid and rainy, very unfavourable for haymaking, but favourable for the growth of green crops and cereals.

#### REVIEWS.

*Sussex Meteorology, 1872.* By F. E. SAWYER, F.M.S. Robinson: Brighton. Post 8vo, 15 pp.

*Temperature of Brighton.* [From *Brighton Herald.*] By F. E. SAWYER, F.M.S.

MR. SAWYER is continuing his efforts to secure efficient observations throughout Sussex, and having the satisfaction of seeing them gradually crowned with success. The first of the two above-mentioned papers is "a complete summary of the Meteorological Observations made in the county," and is decidedly in advance of that for 1871. We trust that the series thus initiated will go on for many years, and that similar publications will be started in many counties, and have no doubt that Mr. Sawyer would be able and willing to give many useful hints to those who might be inclined to undertake their preparation.

The author says (and we agree with him) that "Rainfall observers are still greatly required at, or in the neighbourhood of, West Grin-

stead or West Chiltington, Newhaven or Seaford, and Rye or Winchelsea." But the rainfall details are the strong point of Mr. Sawyer's paper; he must keep that branch up to its present level, but he must try and induce the observers to enable him to make the particulars of pressure, temperature, and natural history worthy of their position by the side of his rainfall statistics.

One other point really ought to be looked to—Sussex is essentially a seaside county. Is it not too bad, that with observers at Hastings, Pevensey, Eastbourne, Brighton, Worthing, and even on Thorney Island, with piers running out to sea every ten or a dozen miles, not a single record appears to be taken of the temperature of the sea. Can any one explain why English observers always neglect this subject?

The second paper contains the result of much hard work, and gives valuable information respecting the temperature in Brighton during the last 33 years, from which we may extract a few of the leading results :—

Absolute highest temperature.....	90·0 on July 6th and 10th, 1852.
Highest monthly mean „ .....	68·9 July, 1852
„ mean monthly „ .....	62·0 July
„ „ yearly „ .....	52·1 1859
Mean temperature of 33 years .....	49·9
Lowest mean yearly temperature .....	46·5 1853
„ „ monthly „ .....	39·1 January
„ monthly mean „ .....	30·6 February, 1855
Absolute lowest temperature .....	12·0 on January 19th, 1838.

In preparing the elaborate tables contained in this paper, Mr. Sawyer has combined observations made in various parts of the town. For the object which he had in view there was no objection to the adoption of that course, but it seems probable that the data in his possession are worthy of more elaborate treatment, and publication in greater detail. Comparison of what may be described as the overlapping portions of the registers in his possession would, doubtless, indicate peculiarities appertaining to each record, and due to differences of position, of instruments, and of exposure. Careful scrutiny of this kind might lead to the discovery of features at present unexpected.

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*Cousen's Concentrated Weather Guide, or Perpetual Table for the United Kingdom, intended as a companion to the Barometer.*  
 Morrell: Bury Standard Office, Bury St. Edmunds.

It would be faint praise to say that this is a better thing than its title implies, or that it is better than any similar broadside we have seen, for no one used to such matters would expect much from the title, and most broadsides are such arrant rubbish that the only difficulty is in surpassing them in uselessness.

It would be perfectly easy to extract a considerable amount of fun from the card now before us, but that is scarcely the reception which should be given to that which the author says has "been tested for more than 20 years, and has rarely been known to fail." The table has

the appearance of having been constructed from actual observation, is so clearly arranged that any one who can read can understand it, and is, we should imagine, very inexpensive. We doubt if others will find it so good as the author says, but as it can probably be purchased for a few pence, and the general arrangement is good, it will be useful in the many houses where a barometer is simply a piece of furniture and an "umbrella guide," and also to those to whom it is too much trouble to master such publications as the *Barometer Manual*, and even to observers as a design which they may adapt to their own localities.

The author says nothing as to the influence of elevation on the reading of the barometer, but merely heads the column "Barometer Scale." As the author presumably resides in the vicinity of Bury St. Edmunds (say 200 feet above sea) the disturbance which would result from the use of the table in such localities as Buxton, Shap, or Braemar has been overlooked. As the table is said to be available for "the United Kingdom," this requires correction.

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# SYMONS'S

## MONTHLY

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### THE VIENNA METEOROLOGICAL CONGRESS.

Our readers are aware that at the Leipzig meeting it was resolved that an official congress should be held this year in Vienna. We are glad to announce that the congress is now sitting, and embraces at least one representative of every European state, except France and Greece (whence M. Schmidt is daily expected), while Austria and Germany have five and six delegates respectively. Great Britain (for reasons which may some day be published) has but two, Belgium has two, while all others have but one each. This inequality in the nationality of the delegates is to a certain extent counteracted by a rule apportioning weights to the votes of the delegates, according to the population of the states which they represent. It is fortunate, perhaps, that there is a fixed maximum for populations of 30 millions and upwards, or the gentleman whom we are glad to see representing China, would surely have had it entirely his own way.

We must, *en passant*, welcome the representative of the Celestial Empire at an international meeting of meteorologists.

The following is a complete list of those present during the first week of the congress, which opened on September 1st and was to sit until the 15th :—

Name.	Delegate for
A. Aguilar .....	Spain
H. Buys-Ballot .....	Netherlands
C. Bruhns .....	Germany
A. Buchan .....	Great Britain
J. D. Campbell .....	China
G. Cantoni .....	Italy
A. Coumbary .....	Turkey
V. Czelechowsky .....	Austria
F. Doergens .....	Germany
E. Ebermayer .....	Bavaria
F. da Silveira .....	Portugal
M. Gloesener .....	Belgium
J. Hann .....	Austria
Capt. Hoffmeyer .....	Denmark
C. Jelinek .....	Austria

Name.	Delegate for
J. Lorenz .....	Austria
H. Mohn .....	Norway
R. Müller .....	Austro-Hungary
G. Neumayer .....	Germany
E. Plantamour .....	Switzerland
E. Quetelet .....	Belgium
R. Rubenson .....	Sweden
G. Schenzl .....	Hungary
H. Schoder .....	Germany
R. H. Scott .....	Great Britain
C. Sohneke .....	Germany
H. Wild .....	Russia
F. Winnecke .....	Germany
A. Zamara .....	Austria.

We congratulate the Committee on the very able delegates who have assembled in response to the invitation of the Austrian Government, and hope that their proceedings will be reported at least as fully

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as those of the preceding congress ; if more fully so much the better.

The programme of proceedings is more systematically arranged than that prepared for Leipzig, but its subjects are mostly identical. The mode of procedure is to refer each question to a committee, and then to discuss their report in a full meeting of all the delegates.

What has been said and done will be more appropriately told in a future article.

## THE HEAT AND THUNDERSTORMS OF JULY 22ND.

(Continued from page 104.)

IN our previous article we gave details of the temperature on the above date. We now proceed to supply an epitome of the effects of the thunderstorms which raged over a large part of the British Isles during the 18 or 20 subsequent hours.

To avoid useless repetition a few initials and rules have been adopted in drawing up the following report ; the initials are as follows : **T**, thunder ; **L**, lightning ; **TS**, thunderstorm ; **TS S**, thunderstorms ; **R**, rain. The rules are (1) that all entries are sorted into counties, and then grouped in the order in which they follow in *British Rainfall* ; (2), that no dates are given ; all those entries which are p.m. being on July 22nd, and all those which are a.m. being on July 23rd.

We may first sum up the casualties. There is one feature in the following table whereby we are able to form an estimate of the small proportion of the total number of casualties which have been reported to us. It depends almost entirely on the severity and extent of a storm what class of accidents are reported. If there is a **TS** over a small area, and of moderate intensity, there will be perhaps one accident to human life, three to cattle, and five or six to trees. As the storm increases in severity and extent it is evidently probable that the numbers should each be similarly increased, but with say five times the number of fatal accidents to human life, we never get reports of other accidents multiplied to the same extent. The following table remarkably illustrates this rule, which is obviously due to the fact of the more important accidents being alone thought worthy of notice. In the present case, with 28 human beings struck, the number of trees reported to be struck is not 150, which is probably the truth, but seven.

*Accidents by lightning between 7 p.m. July 22nd, and 10 a.m. July 23rd.*

Men killed.....	13	Cattle killed.....	38
Women „ .....	3	Sheep „ .....	36
Men struck .....	12	Boats struck.....	2
Houses „ .....	25	Haystacks fired ...	3
Horses killed .....	14	Trees struck .....	7 (?)
Miscellaneous objects struck—granary, abbey, barn, monument, mill, tannery.			

Evidently hardly any one has thought accidents to trees worth reporting, we know otherwise, but cannot convey to the minds of



others conviction of the fact, that for meteorological purposes it is desirable that the site of *every* downstroke should be reported and mapped. To do this is far beyond our power, but we are certain that it would repay any one with the leisure and the inclination to devote himself to it, and we on our part would render to such an one all the help in our power.

We must, however, pass on to the second part of the subject—the intensity of the storms and their geographical distribution, and here (as always will be the case until some one works up the phenomena of thunderstorms as Professor Herschel has those of luminous meteors, or Mr. Symons has those of rainfall) we are met with a difficulty which most persons who see the data on the following pages would not suspect. There is a deficiency of information. We are glad to have it in our power to explain the general features of the phenomena which occurred, but the minor details are sadly deficient.

In England and Wales there was no T S except in a tract of country approximately oval in shape, with its longer axis reaching from Plymouth to Northampton, and its shorter from Portland to Hereford. Within this area occurred the Bath storm, which seems to have come on the Dorsetshire coast from the S. about 9 p.m., and died away in the N.E., after traversing about 130 miles at some 15 miles per hour.

Another T S occurred in North Wales about 5 p.m., and seems to have passed on to Liverpool and thence northwards at least as far as Preston. Whether it was the same which was on the south-west coast of Scotland between 8 p.m., and midnight, there is no evidence to show. Another storm, of great intensity but short duration, burst forth in South Yorkshire about 6 a.m., and seems to have travelled with great rapidity north-westward over Leeds and Bradford, then N.N.E. to the Durham coast, and thence along that of Northumberland to Berwick.

With the exception of Argyleshire and the Hebrides, Scotland appears to have been visited with furious storms, lasting off and on from about 8 p.m. to 8 a.m. It does not seem possible with the present data to individualize them or describe their tracks, but they evidently began earliest in the S. or the centre of the country.

The storm experienced in Dublin about 2 a.m., and which “passed out to sea,” is probably that of the early morning hours at Llandudno, and *possibly* that which we have already mentioned as beginning in South Yorkshire.

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#### ENGLAND.

MIDDLESEX.—No T S occurred in this county, but distant L was seen in W. and W.SW. from *Camden Square* between 1 and 3 a.m., and at *Winchmore Hill* thunder clouds were observed passing to N. about 5 a.m.

KENT.—*Margate*. No T S here.

OXFORD.—*Banbury*. T S 3.40 to 4.10 a.m., and T at 6 a.m.

SUFFOLK.—*Bury St. Edmunds*. No T S.

WILTSHIRE.—*Trowbridge*. House struck.—*Lyneham*. Three sheep killed.—*Marlborough*. Violent T S with heavy R.

DORSET.—*Lyne Regis*. T S began about 0.30 and lasted till 2 a.m., it was of unusual violence, but only one house was struck in this neighbourhood.—*Beaminster*. Heavy T S about 1 a.m.—*Bridport*. A heavy T S began about 8 p.m., lasting to 2 a.m.; the L was bluish, and the flashes were more frequent than I have seen before, mostly sheet but some forked. Within six miles there was much damage done, and some gentlemen in a yacht, trying to make for Lyme Regis, were caught in the centre of the storm, wind blowing in gusts from N.W. to S.W., and so dark they could not see their hands when close to their faces; the L was fearful, and the rain so heavy that they were as wet in two minutes as if they had plunged into the water. The boatman said he had never seen anything to equal it.

DEVON.—*Tavistock*.—T S.

SOMERSET.—*Weston-super-Mare*. From 10 p.m. until towards midnight distant L in S.W. and W. rather frequent; about midnight distant L in S., continuing with great frequency and increasing brilliancy, T S came up about 3 a.m., but had become diminished in intensity. Several flashes within three or four miles. T moderately loud. Smart shower of R, with strong wind, S. or S.W. Storm appeared to move in a S. current. My view commanded the western half of horizon, and I suspect there were other centres of storm passing in the E., besides that which seemed to come up straight from the S. G. F. Burder, M.D.—*Bath*. About 9 p.m. on 22nd there were a few light clouds in W., but I did not apprehend any tempest at that hour. On going to bed about 11.40 I observed very faint L in S.S.E., but so distant that it might have been easily overlooked. At this time the temperature was 74°. Being unable to sleep from the oppressive heat, I got up at 1.15 a.m., and upon looking out of window found the L much brighter and very frequent flashes, every three or four seconds, sometimes oftener. There were heavy clouds in S.S.E. and S. round to S.W., from which the flashes proceeded. Wind very light or *nil*. Bar. 29.930 had been steadily falling from 30.136 on evening of 20th. The L became brighter, and about 1.35 I heard distant T, and feeling sure a storm was at hand, went down stairs and shut some windows left open for coolness. At 1.50 the storm was much nearer, the T loud, and the L of a blinding brightness. I noticed a few pale blue and violet flashes, but most of them were bright yellow. About 2.5 R commenced, and in a few minutes fell heavily. At 2.12 there was a very vivid flash accompanied by the most crashing peal of T I ever heard in England. I thought my house was struck, and after daylight found that a sycamore tree in the garden of my neighbour's house, and not 40 yards from my dining-room window, was struck and much injured. Between 2.12 and 2.16 there were three other very vivid flashes, accompanied by T, but scarcely so loud as that at 2.12. H and R now descended in torrents, and lasted till about 2.24. The storm was directly over the city, but soon passed away to the N.E.,

the L however continued with the same frequency, but the T gradually became less and less audible till 3 o'clock, when it ceased. The sun rose soon after 4 and the L had then disappeared. There was, however, about sunrise, another storm eight or ten miles away in N.W. direction, the T being audible here.—*C. S. Barter*. The accidents in this city were unimportant; in addition to the tree above mentioned, a house was struck in Bathwick Street, a small portion of the N.W. pinnacle of the Abbey was knocked off, two trees were barked, and 12 sheep killed at *Wellow*.—*Shepton Mallet*. Violent T S between .0 and 2 a.m., part of the town flooded.

GLOUCESTER.—*Stroud*. T S at its height here from 3 till 4 a.m., coming up from the S.S.W. and taking an easterly direction. The L was peculiar, like liquid streams pouring from the sky for *more than an instant* of time, besides most fantastic ribbon-shapes in the sky. There was no breeze or wind, and only a few drops of R. At 5 a.m. a sharp thunder shower occurred, with L. Rainfall only .11. The storms were very partial. *Rose E. Stanton*.

SHROPSHIRE.—*Shifnal*. Distant T in S. at 7 p.m. with slight R.

WORCESTER.—*Orleton*. After 3 p.m. great piles of thunder clouds passed over from S. to N., forming at 6.30 p.m. grand masses in the N., with several peals of distant T. On the morning of the 23rd distant T and L passed across to the E. between 3 and 4 a.m., with a very slight fall of R, followed by a bright day and brisk wind.

LEICESTER.—*Leicester*. Distant L in N.W. in evening; no T S here.

LINCOLN.—*Boston*. No T S.—*Grimsby*. Distant T in S. at 10 a.m.

NOTTINGHAM.—*Mansfield*. No T S here though so prevalent elsewhere.

DERBYSHIRE.—*Buxton*. Heavy T S with R = 0.61 in.

LANCASHIRE.—*Liverpool*. Violent T S between 7 and 8 p.m. with heavy R.—*Heaton Chapel*. T from 8 p.m., and heavy T S from S., W. and N. with intervals till 5 a.m.—*Bolton*. T S began at 7.10 p.m., and almost by the first flash four boys in a field were struck, two were killed, their clothes being partially burned and their hair singed. Heavy R followed, and the river Croal rose 3 feet in half-an-hour.—*Dzrubhill*. House struck.—*Willows Lane*. Chimney struck.—*Blackburn*. The most violent T S for 43 years. House struck, also a man.—*Preston*. The greatest T S for many years, lasting off and on from 7.30 p.m. to 9.30 a.m., and passing from S.W. to N.E.—*Hutton*. One man and two horses killed.—*Grimsargh*. Three men killed in a cart.—*Fulwood*. One man killed.

YORKSHIRE (W. Riding).—*Stanley Vicarage, Wakefield*. T S and 0.75 in. of R.—*Pontefract*. T S at 6 a.m. but only lasted half-an-hour.—*Leeds*. Heavy T S between 5 and 6 a.m.; several persons struck.—*Bramhope*. Man killed.—*Woodhouse*. Girl killed.—*Hunslet*. Chemical works struck.—*Bradford*. Violent T S 6 to 7 a.m.—*Fairweather Green*. Two cows killed.—*Pudsey*. House struck.—*Great Horton*. Chimney struck.—*Halifax*. T S and 0.58 in. of R in less than half-an-hour.—*York*. No T S.—*Arncliffe*. Violent T S at 8.30 a.m.

YORKSHIRE (E. Riding).—*Hull*. T S, but no damage reported.

YORKSHIRE (N. Riding).—*Leyburn*. Seven sheep killed.—*Spennithorne*. One beast killed.—*Jervaulx*. Two horses and two beasts killed.—*Ulshaw Bridge*. House struck.—*Raysgill*. Ten sheep killed.—*Northallerton*. T S 6.30 to 8 a.m.—*Brompton*. House struck and woman killed.—*Great Smeaton*. Two beasts killed.—*Pickhill*. Two beasts killed.—*Appleton Wiske*. Tree struck.—*Richmond*. T S 5 to 7 a.m., heavy R, paving stones all washed up, and the sand laid so thick that during the day men were engaged leading it for building purposes. House struck, man also struck at 7 a.m., and his watch smashed in his pocket, yet he was not killed.—*Aske*. Two lambs killed.

DURHAM.—*Seaham*. T S, haystack fired by L.

NORTHUMBERLAND.—*N. Shields*. T S. A fleet of herring boats 15 miles from land were visited by a very heavy storm, and one boat was struck, one man killed, and all the crew but one knocked down.—*Wallsend*. Tannery struck and boy killed.—*Newcastle*. T S at 8 a.m.

WESTMORELAND.—*Elterwater*. Heavy T S and 2.45 in. of R.

#### MONMOUTH AND WALES.

MONMOUTH.—*Llanfrechfa, Monmouth*. Sharp T S at 4 a.m.—*Llan-dudno, Carnarvon*. Very heavy T S 4 to 5.30 p.m., and another about 2 a.m.

#### SCOTLAND.

DUMFRIES.—*Dumfries*. Extraordinary T S in evening and early morning.

ROXBURGH.—*Hawick*. Terrific T S at night, nothing like it ever known here.—*Melrose*. Violent T S 6 p.m. to 6 a.m., L white, red, and violet.

PEEBLES.—*Peebles*. T S, one man killed and one stunned.

BERWICK.—*Coldstream*. Monument struck and the statue thrown from the top. Several houses and trees also struck.—*Berwick*. The most violent T S for many years, lasting from evening till 10 a.m.—*Old Moneylaws*. Woman killed.

LANARK.—*Glasgow*. The most violent T S for at least 50 years, 10 to 12 p.m. and 4 to 5 a.m. Mill and houses struck at *Glasgow*, *Blantyre*, and *Kirkintulloch*.—*Lenzie*. Five cows killed.

AYR.—*Kilmarnock*. Severe T S in S. at 10 p.m., and again at 4 a.m.

FIFE.—*St. Andrew's*. Heavy T S, more L than for many years; max. about 11.30 p.m. Two cows killed.

PERTH.—*Logierait*. Severe T S commenced about 9 p.m. in S., towards midnight it travelled westward, and raged with great violence from 11.30 to 1 a.m., flashes very frequent, and at times the sky presented the appearance of a brilliant aurora; about 5 a.m. the storm began anew, and lasted for more than an hour and a half, at this time being much nearer; heavy R from 6 to 7 a.m.

FORFAR.—*Dundee*. The most fearful T S which has occurred here

for many years between 9 p.m. and 3 a.m.—*Montrose*. T S passed from S.W. to N.E. between 10 p.m. and 4 a.m.

KINCARDINE.—*Lawrencekirk*. The most violent T S for 40 years, between 11 p.m. and 6 a.m.—*Fordoun*. Granary struck.

ABERDEEN.—*Braemar*. T and very vivid L, 4 p.m. to 2 a.m.—*Aberdeen*. Remarkable T S S, 11 p.m. to 1.30 a.m., 2 to 4 a.m., and 6.30 to 9 a.m., with distant T and L during the intervals.—*Cairnbanno*, *New Deer*. House struck.—*Allathan*. Four oxen killed.—*Drum*. Horse killed.—*Huntley*. 11 p.m. L in S., and thence to 2 a.m. such a T S as has never before been known passed to N., between 6 and 7 it returned from N. to S.W. Two horses value £100, killed at *Huddoch*, another at *Gartly*, and “A water-cask at *Connycluck* was destroyed, a large round hole being made in the side of it by the L.” One horse and two oxen killed at *Drumblade* at 8 a.m.—*Alford*. T S passed from W. to E., max. 12 p.m. to 2 a.m.—*Tough*. No such T S remembered. Three oxen killed at *Mains*.—*Leochel-Cushine*. T heard from 5 p.m., max. 11.30 to 3 a.m.—*Portstown*. Barn struck.—*Whitehouse*. Three oxen killed.—*Monymusk*. One ox killed.—*Kintore*. Cow killed.—*Crichie*. Horse killed, two oxen killed at *Daviot*, and two near *Rayne*.—*Inverury*. At the postal telegraph office the L melted a gas pipe and lighted the gas.—*Fyvie*. T 8 p.m. in S., heavy T S at 2 a.m.—*Greenmire*. House struck.—*Ardlogie*. Mill struck.—*Tifty*. Horse killed.—*Woodhead*. Calf killed.—*Springsley*. Two cows killed.—*Netherton*. House struck.—*Turriff*. The telegraph wires at the post-office were snapped asunder, and the window-blinds set fire to from the electric current having entered the window at the aperture for the wires. At *Sunnyhill* the L entered Mr. Ingram's house and did considerable damage to the walls and roof. At *Auchinhamper Inverkeithney* a cow was killed. At *Strocherie* near *Plaidy* two sheep killed.—*Peterhead*. T S 10 p.m. to 8 a.m.; no damage reported.—*Fraserburgh*. 10 p.m. to 10 a.m. T almost incessant, and from 10 p.m. to 1 a.m. L one continued blaze, but mostly horizontal.—*Macduff*. Most violent T S ever remembered, especially from 0 to 2 a.m.

BANFF.—*Tillynaught*. T S, two horses killed.—*Grange*. T S, two haystacks fired.

ELGIN.—*Forres*. The most violent T S ever experienced in this part of the country, continuing two hours and a half during the night.

NAIRN.—*Nairn*. Severe T S.

ROSS.—*Strathconan*. Great T S between 1 and 2 a.m.—*Lochbroom*. About midnight the most severe T S remembered; it lasted three hours, and though no damage was done here, a man and horse were killed not far off.—*Tain Springfield*. Very violent T S between 2 and 3 a.m.

INVERNESS.—*Portree*. The T S did not reach *Skye*.—*Dalwhinnie*. T S at midnight.—*Aviemore*. During the T S there was the grandest display of L we ever saw.

SUTHERLAND.—*Golspie*. T S, man killed in the W. of the county.

CAITHNESS.—*Wick*. A fishing-boat at sea struck and the crew stunned.—*Lybster*. House struck.

ORKNEY.—*Sandwick*. Severe T S, sheet and forked L from 7 to 9 p.m., and till 10 a.m.

#### IRELAND.

DUBLIN.—*Rockville, Blackrock*. We have had here at an early hour, a very violent T S, with an extraordinary amount of R. It commenced at about 2 a.m., with almost continuous vivid L and immediate R; no H. In two hours I registered 2.02 in., but more remarkable still, in about 30 minutes there fell 1.50 in. I have kept a registry for 34 years, but I never recorded anything like this. The storm came from S., veered to the E., and then again rapidly to N.W. *Thomas Bewley*.—*Monkstown*. Severe T S from 1.30 to 3 a.m., accompanied by very heavy R; 1.95 in. fell in four hours.—*Balbriggan*. About 2 a.m. I was awake by a loud peal of distant T and vivid flashes of L of intense brilliancy. For a considerable time the T was very distant, 30 or 40 seconds intervening between the flash and the report. About 3.30 it became nearer, and passed out towards sea. I have heard that at *Rush*, about seven miles distant, it was very close. The storm lasted till near 5 o'clock, and at 3 o'clock there was very heavy R, the amount in my gauge at 9 next morning was 0.70 in. *Samuel P. Warren*.

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#### REVIEWS.

*Quarterly Weather Report*. Published by authority of the Meteorological Committee. Part I., January–March, 1871. Part III., July–September, 1872. Stanford, 4to, 1873.

SOMETHING like an enigma attaching to the appendices to these parts, and several persons having declared that they could not understand them, we think a few words devoted to the subject may not be inappropriate. It will tend to clear comprehension, and probably in the end save time if we begin our narrative at the beginning, sixteen years ago. At the British Association Meeting, in 1857, a wish was expressed that self-recording anemometers should be established on some of the Islands in the Atlantic Ocean. Two such instruments were constructed during 1858, at the expense of the Board of Trade and Admiralty, and after being verified at Kew they were, early in 1859, erected, one at Halifax and one at Bermuda. The records from Bermuda, April 1859 to September 1860, were tabulated on the plan adopted by Lord Wrottesley, and published in 1861, as the eighth number of Admiral FitzRoy's Meteorological Papers. The records of the Halifax instrument, July 1859 to June 1861, were reduced on exactly the same plan, and published in 1865. Early in the year 1862, it was found impossible to continue observations at Halifax, and the instrument after repair was erected at Sandwick Manse, Orkney,

in the autumn of that year. In the Quarterly Weather Report, Part I., January–March, 1871, the Orkney records, 1863–1868, are reduced and discussed on the method of components. In the Quarterly Weather Report, Part III., July–September, 1872, is printed a discussion of the whole of the Bermuda records upon the same system.

Considering how severely Lambert's formula was handled, and by what a majority it was condemned, at Leipzig, we are surprised that the Meteorological Committee (who are all but pledged to adopt the resolutions of the Congress), should have published observations discussed on a plan so closely resembling that which has been condemned. It is needless to add anything to the condemnation, or to add our feeble criticism to that of far abler men, and we but follow the precedent of the Committee in condemning without explaining, for they dismiss the method devised by Admiral FitzRoy, after much conference with the late Lord Wrottesley, with the following brief notice:—

“As the treatment of the materials was entirely different from that now adopted, not being on the principle of components, no use could be made of this publication.”

We are very glad that the previous publications were “not on the principle of components,” for had they been, Dove could not have obtained the data he has quoted, and 99 persons out of a 100 would have been unable to ascertain what was observed and recorded. While by the old method—

“The fourth and last table for each month was formed from the original traces, to supply such additional information respecting the veering of the wind as could not be given in the first table. By careful use of the first and last table of each month conjointly, almost every variation indicated by the instrument may be determined, for the registers may be reproduced from the above tables with a very near approach to identity.”

Perhaps, it may be as well to state that the general principle of the method of components is this,—a wind, say from N.N.E., is classed partly under N. and partly under E., of course more to the former than the latter. Secondly, the sum of all S. winds is taken from that of all N. winds, and the W. from the E., and the residue is set down as the wind's motion. Therefore, suppose we have a S.W. wind blowing for four hours, with a velocity of thirty miles per hour, and afterwards a N.E. of the same duration and force, the entry would be O.

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*Annalen des Physikalischen Central Observatoriums, Herausgegeben von H. WILD, Director.*—Jahrgang, 1870; St. Petersburg, 1872; 4to, 723 pages.—Jahrgang, 1871; St. Petersburg, 1873; 4to, 777 pages.

IF one wanted an illustration of the cosmopolitaneity of science, or its independence of nationality, of custom, of dynasties, and of political systems, the two bulky volumes now before us would afford an excellent

text. Just as in America, through the joint action of the authorities of the great Republic and those of our own Canadian Dominions, the network of telegraphic meteorological stations now reaches from the sunny shores of the Mexican Gulf to Nova Scotia, and from the Atlantic to the Pacific, so the autocratic Russians have their system, not wholly telegraphic, however, reaching from the Baltic to the Uralian Mountains, and across Siberia to the far east at Peking, and from the shores of the Caspian to Archangel. Before passing on to notice these bulky volumes, we feel bound to call attention to the unequal geographical distribution of the stations. In 1870 there were altogether 47, distributed as shown in the following diagram :—

	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
N. Lat. 70°	1	1	1	...	...	...	...	..	..	...	
60°	10	4	2	4	2	...	1	...	...	1	
50°	1	6	9	...	2	...	...	...	1	...	
40°	...	...	...	...	...	...	..	...	...	1	
30°											1

From this it will be seen that out of the 40 squares 6 adjoining ones have 35 out of the 47 stations, in short—that *less* than one sixth of the area has *more* than two-thirds of the stations. Such a disproportion might easily be accounted for were the system a voluntary, and not an official one, for it will be readily understood that in the former case the directors can only obtain that which is offered to them, while a Government department has but to give the order, and to see that it is obeyed. The only other reasons which occur to us for such an unequal disposal of observing strength are the existence of special features in the physical geography of certain districts. We may illustrate this argument by reference to a case familiar to all our readers. Would anyone contend that as many rain gauge stations per 100 square miles are required in the flat counties of Huntingdon or Bedford, as in the hilly parts of Cumberland? So we could readily have understood an excessive proportion of Russian stations along the Urals, or, as we are glad to see is the case, in the Caucasus; or chains of stations along or across given meridians, in order to watch the progress of storms and meteorological phenomena across the vast territory over which Russian influence is supreme. Or we thought it possible that the excess of stations in European over Asiatic Russia, which is about 7 to 1, might arise from a desire to provide statistics bearing on agricultural pursuits, but the absence or paucity of stations in the water sheds of the Don and the Volga, and the way in which they are crowded round the Baltic, hardly seem to accord with this view. We are glad to notice that in 1871 returns are published from two or three additional Asiatic stations, among which the two following are very important :—



Nikolajewsk (on the Amoor), Lat.  $53^{\circ} 8' N.$ , Lon.  $140^{\circ} 45' E.$   
 Jenisseisk ..... „  $58^{\circ} 27' „ „ 92^{\circ} 8' „$

Having pointed out a feature which (so far as our present knowledge extends) seems to require attention, we have the much more agreeable duty of noting the many excellencies of the works before us. In the first place, there is the question of language, which the Director has solved by the happy expedient of printing the letterpress in double columns, one Russian and one German. (By the bye, it would tend to ensure a wider circulation, or, at any rate, more general perusal of the meteorological publications of all countries if the Vienna Congress or other body could decide on *some one language* which, jointly with the national one, should be used in all publications intended for international use. Considering the very large body of English speaking observers on both sides of the Atlantic, in Australia, and in India, we think that a strong case might be made out for its adoption as the general language of the science; but if that proposal is rejected, we should strongly recommend Latin, the cessation of the use of which, for scientific purposes has always seemed to us a matter of regret.) As a record of observations, the above works are singularly complete. They commence with a reference to the instructions issued to the observers, then proceed to explain the various symbols used (many of which are extremely appropriate), the scales used for wind force, and amount of cloud, the hours of observation, and mode of computing the various means. Then follow brief notes upon each station, stating its position, by whom the observations were made, the height of the various instruments above the ground and above sea level, with details as to the mode by which the latter has been determined.

In the *Annalen* for 1870 this is followed by a note from Director Moritz, of Tiflis, calling attention to the want of uniformity in hours of observation, modes of reduction, wind scales, &c., which would be amusing if the results of the present anarchy were not so excessively troublesome.

The observations are taken at 7 a.m., 1 and 9 p.m., and are printed in extenso, and give (1) Temperature, (2) Absolute and (3) Relative Humidity, (4) Pressure, (5) Direction and Force of Wind, (6) Amount and character (Howard's) of cloud, (7) Remarks. At 1 p.m., observations are made of the total fall of rain, and of the direction of the clouds.

At the end of the volume the records of the self-recording instruments at St. Petersburg are tabulated for each hour. Our readers may remember that the pressure at St. Petersburg was remarkably high on February 6th, 1870; we therefore think it may be interesting and useful to give (converted) the hourly record for that day as indicated by the barograph, and as observed in the regular daily observations. The altitude correction of 0.020 in. (for 16 ft.) being applied in both cases. We are glad to find that the agreement reflects equal credit upon the observers and the instruments.

*Mean pressure at St. Petersburg reduced to 32° sea level.*

1870.	Barograph.	Eye Obsrvn.	Feb. 6th, 1 p.m.	Barograph.	Eye Obsrvn.
Feb. 6th, 1 a.m.	31·095	...	Feb. 6th, 1 p.m.	31·135	31·139
" 2 "	·099	...	" 2 "	·131	...
" 3 "	·099	...	" 3 "	·131	...
" 4 "	·103	...	" 4 "	·135	...
" 5 "	·107	...	" 5 "	·131	...
" 6 "	·119	...	" 6 "	·127	...
" 7 "	·127	31·135	" 7 "	·127	...
" 8 "	·127	...	" 8 "	·127	...
" 9 "	·131	...	" 9 "	·119	31·115
" 10 "	·135	...	" 10 "	·119	...
" 11 "	·135	...	" 11 "	·119	...
" noon	·135	...	" midnight	31·115	...

Mean pressure for the day .... 31·122 in.

,, temperature ,, (Fahr.)..... —11°·7

Our remarks upon the 1870 volume have occupied so much space, that we can only say, that that for 1871 is a worthy successor to that for 1870.

### A LOCAL DOWNFALL.

*To the Editor of the Meteorological Magazine.*

SIR,—A fall of rain which took place here last Wednesday is worth recording.

The day was showery, but probably not more than a few hundredths of an inch had fallen before 9 p.m. At that time heavy rain commenced, and lasted until about 3 a.m. on Thursday (September 4th). The amount in the gauge at 8 a.m. was 1·85 in.

This fall of rain seems to have been confined to a very small area. At Holyhead only 0·01 in. was recorded, and my friend, Mr. Ewart, at Hoole Bank, Chester, 11 miles S.S.E. of this place, recorded only 0·40 in. At Bidston Observatory, nine miles N. from here, Mr. Hartnup noted 1·39 in., but the authorities seem to doubt his accuracy, as they place a query against his return in the weather report. During the whole of last week thunder and lightning were frequent.

Yours faithfully, REGINALD BUSHELL.

*Hinderton, Neston, Cheshire, Sept. 9th, 1873.*

### BOOKS RECEIVED.

#### FRANCE.

SOCIÉTÉ MÉTÉOROLOGIQUE DE FRANCE.—“Annuaire ; Tome Dix Septième, Tableaux, Feuilles 5—10.”

“Tome Huitième Bulletin des Séances, Feuilles 15—21.”

“Tome Dix Neuvième ,, ,, Feuilles 10—17.”

#### MAURITIUS.

METEOROLOGICAL SOCIETY.—“Monthly Notices—January, 1873.” Fcap. folio.

#### NETHERLANDS.

KONINKLIJK NEDERLANDSCH METEOROLOGISCH INSTITUUT.—“Temperatuur van het Zeewater aan de Oppervlakte van het gedeelte van den Noorder Atlantischen Oceaan.” Manssen, Utrecht, 1872. Oblong folio.

#### RUSSIA.

WILD, H.—“Annalen des Physikalischen Centralobservatoriums.” Jahrgang. 1870. St Petersburg, 1872. 4to.  
Ditto, 1871. ,, 1873. ,,

# AUGUST, 1873.

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.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Days on which 1/2 or more fell.	Max.		Min.					
				Dpth	Date.		Deg.	Date.	Deg.	Date.	In shade	On grass.		
		inches	inches.	in.										
I.	Camden Town .....	2·87	+ ·23	·87	24	16	86·4	8	47·7	29	0	0		
II.	Maidstone (Linton Park) .....	2·13	— ·58	·48	19	15	92·0	8	46·0	29†	0	0		
„	Selborne (The Wakes) .....	2·36	— ·82	·47	23	18	83·0	8	46·5	29	0	0		
III.	Hitchin .....	2·17	— ·18	·46	24	19	77·0	8, 16	45·0	28	0	...		
„	Banbury .....	2·61	+ ·48	·37	24	19	80·0	7	42·5	4	0	...		
IV.	Bury St. Edmunds (Culford) .....	2·19	— ·25	·82	24	12	84·0	8	43·0	3	0	0		
V.	Bridport .....	3·46	+ ·87	·72	24	17	81·0	8	47·5	2	0	...		
„	Barnstaple .....	7·19	+ 3·00	1·74	24	19	77·5	8	51·0	19	0	...		
„	Bodmin .....	6·54	+ 2·68	·99	18	27	75·0	7	49·0	20	0	0		
VI.	Cirencester .....	2·61	— ·23	·48	24	17	...	...	...	...	...	...		
„	Shifnal (Haughton Hall) .....	3·17	+ ·30	·39	28	23	78·0	7	47·0	23†	0	...		
„	Tenbury (Orleton) .....	3·63	+ ·75	1·46	24	22	81·7	7	44·0	4	0	0		
VII.	Leicester (Wigston) .....	2·68	+ ·49	·48	18	19	82·0	7, 25	45·0	16	0	...		
„	Boston .....	2·91	+ ·62	1·10	24	13	82·0	7	43·0	29	0	...		
„	Grimsby (Killingholme) .....	2·69	...	1·37	18	15	76·0	7, 8	45·0	11	0	...		
„	Derby .....	2·92	+ ·32	·57	19	23	78·0	7	47·0	29	0	...		
VIII.	Manchester .....	4·20	+ ·70	·53	4	27	79·0	7	48·0	4	0	...		
IX.	York .....	2·15	— ·56	·34	24	19	71·5	7	46·0	11	0	...		
„	Skipton (Arnccliffe) .....	6·68	+ ·74	·57	20*	30	72·0	15	39·0	14	0	...		
X.	North Shields .....	3·47	+ ·62	·48	28	20	72·0	7	45·0	11	0	...		
„	Borrowdale (Seathwaite) .....	18·73	+ 4·65	1·66	17	29.	...	...	...	...	...	...		
XI.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...		
„	Haverfordwest .....	6·05	+ 1·17	1·34	24	23	75·0	7	48·0	29	...	...		
„	Rhayader (Cefnfaes) .....	5·77	+ 1·11	2·05	28	27	74·0	...	44·0	...	...	...		
„	Llandudno .....	2·44	— 1·38	·47	24	18	76·6	7	49·6	29	...	...		
XII.	Dumfries .....	5·80	+ 1·93	1·13	20	27	71·0	7	43·0	11	...	...		
„	Hawick (Silverbut Hall) .....	4·09	...	·73	24	24	...	...	...	...	...	...		
XIV.	Kilmarnock (Annanhill) .....	5·12	...	·87	15	26.	69·1	27	41·1	11	...	...		
XV.	Castle Toward .....	4·89	— 1·41	1·15	13	22-	70·0	7	...	...	...	...		
XVI.	Leven (Nookton) .....	3·43	+ ·44	·80	19	22	72·0	7	39·0	11	0	0		
„	Stirling (Deanston) .....	4·82	+ ·20	·84	15	25	69·0	26	35·8	11	0	...		
„	Logierait .....	2·67	...	·35	12	16	72·0	7	33·0	19	...	...		
XVII.	Braemar .....	2·64	— 1·20	·38	21	21	66·1	7	30·0	20	2	3		
„	Aberdeen .....	4·08	...	·67	21	23	73·0	6	36·1	11	0	1		
XVIII.	Inverness (Culloden) .....	1·98	— 1·27	·27	11	14	66·9	26	44·1	21	0	1		
„	Portree .....	7·41	— ·04	1·29	13	27	...	...	...	...	...	...		
„	Loch Broom .....	5·75	...	·58	16	27	...	...	...	...	...	...		
XIX.	Helmsdale .....	3·29	...	·76	13	21	...	...	...	...	...	...		
„	Sandwick .....	4·06	+ ·35	·90	12	22	64·0	27	38·0	11	0	1		
XX.	Caherciveen Darrynane Abbey .....	5·95	...	·66	3	27.	...	...	...	...	...	...		
„	Cork .....	3·24	...	·81	17	13	...	...	...	...	...	...		
„	Waterford .....	6·00	+ 2·05	1·46	23	20	75·0	7	45·0	17	...	...		
„	Killaloe .....	8·61	+ 3·68	1·32	26	30	...	...	...	...	...	...		
XXI.	Portarlinton .....	4·33	— ·17	·53	16	28	76·0	7	45·0	29	...	...		
„	Monkstown .....	3·35	+ ·14	·90	24	20	...	...	...	...	...	...		
XXII.	Galway .....	6·28	...	1·13	23	25	69·0	13	44·0	27	0	...		
„	Bunninadden (Doo Castle) .....	5·35	...	...	...	...	...	...	...	...	...	...		
XXIII.	Waringstown .....	5·11	...	·80	15	26	75·0	7	45·0	4	...	...		
„	Edenfell (Omagh) .....	6·15	...	·82	12	28	70·0	7	40·0	16	...	...		

\*And 26. †And 30. ‡And 29. ||And 31.

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

## METEOROLOGICAL NOTES ON AUGUST.

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

## ENGLAND.

LINTON.—A fine warm month, with just sufficient R to meet the wants of growing and ripening vegetation, winds (never high) mostly from S. and S.W. T on 1st, 19th, and 26th. Bar. more steady than usual, highest on 2nd, lowest on 19th, and hottest days the 7th, 8th, and 9th.

SELBORNE.—Harvest generally begun on 11th. First half of the month very dry, the remainder wet, R every day but two after the 16th. In the last fortnight of July and first fortnight in August little more than half an inch of R fell.

BANBURY.—TS at 7 p.m. on 24th, and a more severe one at 9 p.m. on 25th. Wind high on 8th and 12th.

CULFORD.—The max. temp. of August was 84°, min. 43°, and mean of month 61°·8. Westerly winds on 24 days. A terrific TS on the night of the 24th, T also on 19th, 26th and 28th. Although the rainfall has been rather considerable (2·19 in.), the weather throughout the month has been favourable for harvest operations, which in most instances (in this locality) are nearly finished, and the grain generally speaking in good condition.

BRIDPORT.—23rd, 70 in. fell from 7.15 to 8 a.m.; much L in the evening. 24th, storm at intervals during the day, much L with heavy showers in the evening.

BODMIN.—Rainfall 3·27 in. above the average of 24 years; the wettest August ever recorded in Bodmin, and most disastrous for the farmers. Terrific T and L from 8 to 10 p.m. on 24th.

SHIFNAL.—A most trying month for the farmers, for although the crops of grain, especially on light soils were good, little has been got in in good order, and the greater part, although cut, left out to the close of the month and beginning of September. R daily from 15th, but the temp. being low less damage ensued than might have been expected. The winds were chiefly from W. and N.W. to the 16th, when they changed to S.W. and S.E. T only once, viz., on night of 25th, when it was distant with continuous L. Swedes and mangolds flourishing, apples an average crop, few pears, scarcely an apricot or damson, few plums of any sort, few mushrooms. Only one peacock and one tortoiseshell butterfly seen, and but few white ones. Swifts all here in great numbers on 10th, and all gone on the 12th.

ORLETON.—Cloudy, very few bright days, and frequent light falls of R till the 24th, when the day was cloudy and sultry, towards 5 p.m., a dark mass of stormy clouds collected in the sky to the S.E., at 7 p.m. R began to fall, suddenly followed by a bright flash of L, and T in the S., and great R till 9 p.m., with a few more flashes of L and distant peals of T; the R then ceased, but the L was seen in the N.E. till midnight, and there were a few sharp showers; between 7 p.m. and 9 p.m. nearly 1·40 in. of R fell; much T and L on the following day between 7 p.m. and midnight, but very little R; the remainder of the month was very stormy and bad for the harvest; R every day after the 15th.

WIGSTON.—Very unsettled weather throughout the month, the corn in this neighbourhood is generally cut, but very little of it is carried, the weather being so showery.

BOSTON.—Wheat cutting generally begun by 11th. 24th, wind N.E. in the morning. S.E. at 9 p.m. Very severe TS; fall of rain 1·10 in. 25th, hot and very moist, like a vapour bath.

GRIMSBY.—A very fine month, and the corn crops better than could have been anticipated from their condition in the spring. Root crops of all kinds abundant, and potatoes more sound than for many years past. First wheat cut on 7th, harvest general on 13th. T at 10.10 a.m. on 9th. TS and heavy R at 11 p.m. on 18th and early morning of 19th, with a fall of 1·37 in. 24th, L at 9.45 p.m. 25th, T and R from very early till 7.30 a.m., T at 7.30 p.m., and L 10 to 11 p.m. 28th, TS at 3 p.m., L at 9.30 p.m., high wind at night.

**DERBY.**—A very damp and disagreeable month, only eight days without R ; notwithstanding the number of days on which R fell, the total fall was very little above the average for August.

**MANCHESTER.**—Aurora on 8th, T and L on 9th, 25th, and 28th.

**ARNcliffe.**—The whole month dark and dreary. "Hay time" not all finished yet (September 1st).

**NORTH SHIELDS.**—T S on 9th and 25th.

**SEATHWAITE.**—1 in. or more fell on nine separate days ; T on 8th, 16th, 19th, and 25th.

# W A L E S .

**HAVERFORDWEST.**—A chilly wet month, scarcely a dry day ; very bad harvest weather—thus ends the last of the summer months ; truly this year it may be said in this country, "We have waited for summer which never came." An enormous rainfall on the 23rd and 24th, 1·84 in. fell in 23 hours ; temp. reached 70° only on six days.

**CEFNFAES.**—A wet ungenial month. 24th, T S in the afternoon, with heavy R at 5 and 8 p.m. ; 28th, continued downpour in the evening for some hours, from 3 p.m. to 8 p.m. ; total fall 2·05 in.

**LLANDUDNO.**—L on the evening of the 18th ; 24th, at 10 p.m., R with T, peals of T during the night ; 25th, sheet L in the evening.

# S C O T L A N D .

**DUMFRIES.**—This has been another wet month, only four days on which no R was recorded. The heaviest rains were generally during the night, and the weather during the day was often dry and fine. Harvest commenced on the 5th, but much interrupted by wet weather, especially the leading of grain. Wheat about an average, oats above it, potatoes good but much diseased, turnips heavy crop, fruit generally deficient.

**HAWICK.**—The month on the whole has been rather a wet one, but the crops all looking well. Potatoes a little diseased, but are a beautiful crop. We had a severe T S on the night of the 24th and on the 25th.

**ANNANHILL.**—On 12th, strong S.S.W. wind in evening, 55 miles per hour ; another gale on 16th, with T and brilliant flashes of forked L and heavy R, T S also on 25th, the rest of the month calm. Ozone well developed. Harvest operations in full vigour, most of the oats in this district cut, but the wheat is late, and the wet weather has still kept some of the hay out ; potatoes a good crop, but much diseased. *Lime* trees beginning to drop their leaves, but foliage, as a rule, still good. Death-rate here 57, or equal to 28 per thousand, consumption heading the list, then heart disease ; no epidemic. The county still free from cattle disease.

**CASTLE TOWARD.**—A wet, cloudy, overcast month, little or no sunshine, prevailing winds W., S., and S.W. 10th, heavy T S at 10 p.m., followed by heavy R. Another storm on 26th, followed by very heavy R at 11.40 a.m., doing much damage to the outstanding crops, which were laid flat ; the following days being dry the harvest operations went on rapidly. Turnips never looked better ; potatoes suffering very much from disease, fruit of all kinds plentiful, grass in abundance, and cattle healthy.

**LOGIERAIT.**—Rather unsettled weather for the harvest operations ; crops on the whole a full average. T on 26th.

**BRAEMAR.**—Shower of H with T on 16th, frost on 20th, very injurious to the potato crop ; weather in general dark and dull ; L on 25th and 26th.

**ABERDEEN.**—A month of dull wet weather, especially the latter part, and by no means favourable for harvest ; potatoes blackened by the frost on the 11th, and disease became very apparent about the 25th. Frequent L, especially during the last ten days.

**PORTREE.**—Wet squally month, more than an inch of R fell on the 13th ; the greatest part of the hay crop is still unsecured, owing to the constant wet weather there cannot be now any general shearing of corn before the 20th of September, and not even then unless the weather gets finer. Cattle and sheep healthy, and

selling at high prices. Gale from W. to S.W. on 7th, and from S.W. on 16th, heavy H showers on 3rd and 8th, on the latter date the hailstones covered the ground about half an inch thick for upwards of two hours.

LOCHBROOM.—A month of almost constant E, only four days on which it is not recorded. The hay crop has been much damaged, and securing it much delayed, by the E; the other crops are over-ripe, but can neither be cut nor carried. Potatoes are still sound in this locality.

SANDWICK.—August has been wetter and rather colder than the mean, but the weather has not been unfavourable to vegetation. A bright meteor shot from S. to N. of zenith about 11 p.m. on 22nd.

#### I R E L A N D.

DARRYNANE.—Wind constantly W. or N.W., and weather showery throughout the month, harvest consequently very backward.

WATERFORD.—The latter part of the month cold, wet, and stormy, more like what we should expect at the end of September. L is a very rare phenomenon here, but some of the flashes on the 24th, about 7 p.m., were very vivid; they were not numerous and soon ceased, though the E was heavy.

MONKSTOWN.—L on 24th, and very vivid, with loud T about 9 p.m. on the following day.

DOO CASTLE.—Hay crop beyond recovery, having been cut more than three weeks and exposed to continued downpour. The potato crop much affected by disease.

WARINGSTOWN.—Very wet but not cold, harvest late, only commencing at the end of the month. Very heavy TS on the night of the 25th.

EDENFELL, OMAGH.—The wettest and most unfavourable August for harvest purposes on record here; an abundant cereal harvest in much danger, grass and green crops rather benefited by it.

### STEVENSON'S THERMOMETER STAND.

*To the Editor of the Meteorological Magazine.*

SIR,—I should like to be permitted to ask a question or two. Does Mr. Buchan recommend that the Stevenson screen should be placed on the north side of a house, as it was at Strathfield Turgiss last year? If it had been in the open, would not the difference of  $7\frac{1}{2}^{\circ}$  on the days selected have been reduced to  $2^{\circ}$  or  $3^{\circ}$ ? If there were absolutely no wind, would the temperature on the north side of a large building change at all, and if so, why, and how much? Since it does actually change, must not the change depend upon (1) the force of wind, (2) the length of the shadow of the house, *i.e.* the distance from which air warmed by the sun shining on the ground has to be brought, (3) the rapidity of the change taking place in the temperature of the air in the open? And lastly, if this be the case, ought not those who place instruments in such positions to discover the necessary corrections for the temperatures observed?—I am, Sir, your obedient servant,

F. W. STOW.

*Harpenden, August 29th.*

[We are not aware that Mr. Stow expects to elicit from the unfortunate individual who is working gradually through the collected data on this subject any expression of opinion, or decision; but if he does, and is disappointed, we trust he will not for a moment attribute it to any failure of courtesy or appreciation of the many excellent hints which Mr. Stow has from time to time offered, but to the steady maintenance of a fixed resolution.—ED.]

# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

XCIIL.]

OCTOBER, 1873.

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

### THE BRITISH ASSOCIATION AT BRADFORD.

THE recent meeting has had one singular feature with respect to meteorology,—not only has there not been a single paper by any local observer, but there has not been one from Yorkshire, or any of the northern counties, and only one (communicated to the Botanical section), from Scotland. We regret that some of the able northerners present did not bring forward some of the stores of information which we know them to possess. It was otherwise in Brighton last year, and we hope will be otherwise in Belfast next year.

Annexed is our usual list of observers, past and present, who attended the meeting :—

Ackland, Rev. T. S. Balne.	Lawton, W. .... Hull.
Brooke, C., F.R.S. ... London.	Lund, C. .... Bradford.
Crompton, Rev. J. ... Norwich.	McLandsborough, J., C.E. Shipley.
Crossley, E. .... Halifax.	Melville, A. L. .... Lincoln.
Crossley, L. J. .... "	Moffat, T., M.D. .... Hawarden.
Dawson, H. ... Keswick.	Muirhead, H., M.D. ... Cambuslang.
Dymond, J. J. .... Ilkley.	Pengelly, W., F.R.S. ... Torquay.
Elliot, R., F.R.S.E. Hawick.	Phillips, Prof. J., F.R.S. Oxford.
Everett, Prof. J. D. ... Belfast.	Robson, J. W. ... Huddersfield.
Field, Rogers, C.E. ... London.	Smith, D. ... Birmingham.
Filliter, E., C.E. .... Leeds.	Smyth, J., junr., C.E. ... Banbridge.
Foster, W. .... Queensbury.	Sopwith, T., F.R.S. .... London.
Galton, F., F.R.S. ... London.	Stewart, Prof. B., F.R.S. Manchester.
Glaisher, J., F.R.S. ... Blackheath.	Symons, G. J. .... London.
Gott, C., C.E. .... Bradford.	Waterhouse, J., F.R.S. Halifax.
Grabham, G. W., M.D. Redhill.	Watts, W. .... Piethorne.
Harrison, J. P. .... Ewhurst.	Whipple, G. M. .... Kew.
Herschel, Prof. A.S. Newcastle-on-Tyne	Wilson, C. .... Garstang.
Hooker, J. D., M.D.,	Woodd, C. H. L. .... Hampstead.
F.R.S. .... Kew.	Woodward, C. J. .... Birmingham.

On looking over this list, one cannot but regret that amid the one, two, or three thousand members and associates it is very difficult to pick up individual persons whom one wishes to meet. It also seems a pity that, as a rule, meteorologists do not hold more together than they have done. At the Edinburgh meeting Mr. Milne Home, as Convener of the Council of the Scottish Meteorological Society, gave a breakfast to the principal meteorologists at the meeting. We cannot expect to find

a Mr. Milne Home at every town the Association visits, but surely it only requires *the will*, to arrange for a friendly breakfast limited to meteorologists, and to take place on the morning of the day (the Monday) appropriated by long established custom to the discussion of Meteorological papers in section A.

The following is the list of papers and the order in which they were read :—

- G. J. Symons*, On Negretti's Test Gauge Solar Radiation Thermometer.
- Prof. Balfour*, Report on the Influence of Forests on Rainfall.
- Prof. Zenger*, On the action of symmetrical conductors and lightning conductors.
- F. H. Wenham*, On the influence of temperature on the elastic force of springs.
- G. M. Whipple*, On a new new form of Rutherford's minimum thermometer.
- Prof. Everett*, Report of the Committee on Underground Temperature.
- G. J. Symons*, Report of the Rainfall Committee.  
On the Rainfall of 1872.
- Prof. Herschel*, On the conductivity of rocks.
- S. H. Miller*, Experiments on Evaporation and Temperature.  
Documents relating to the establishment of meteorological stations in China.
- G. M. Whipple*, On a new electrical Anemograph.
- J. Glaisher*, Report of Committee on Luminous Meteors.
- Rogers Field*, On a new aneroid barometer.
- C. Meldrum*, On a periodicity of cyclones and rainfall in connection with the sunspot periodicity.
- Arturo de Marcoartu*, On the application of telegraphy to navigation and meteorology.
- Arthur Schuster*, On a curious phenomenon observed on the top of Snowdon.
- G. M. Whipple*, On the passage of squalls across the British Isles.
- J. Park Harrison*, Lunar influence on clouds and rain.

According to custom we give precedence to the several reports, but hope in subsequent numbers to give abstracts of all the above papers, and of the discussions upon them.

### THE INFLUENCE OF FORESTS ON RAINFALL.

Professor Balfour submitted the report of the Committee on the Influence of Forests on Rainfall.

It stated that, after some inquiry and correspondence, the committee heard of two localities, viz., Carnwath, Lanarkshire, and Abernethy, Speyside, Morayshire, which seem likely to be suitable stations for carrying on the inquiry entrusted to them, owing to wood likely to be cut down soon, and assistance expected from the proprietor. The station in the Speyside district the committee had not yet been able to visit, but a sub-committee visited Carnwath on the 11th July last. Three stations were placed at the disposal of the Committee, and Mr. McLean offered most handsomely to cut down the trees at the station which should be selected at the time, and in the quantity which would, in the opinion of the committee, best suit the objects of the inquiry. The three localities were visited by the sub-committee, who fixed on one as the best. The extent of woodland on which it was proposed to place the station was 62½ acres, but there was a much greater extent of woodland in the neighbourhood. (A tracing showing these areas was exhibited in the section). The committee proposed to erect two sets of instruments, and that the instruments should be read twice daily. It was proposed, for one year at least, to compare the observations on the wooded and naked knolls, and to cut down none of the trees ; and it was also proposed to delay the planting of rain gauges at Nos. 1 and 2 until a sufficient space had been cleared around No. 2 by cutting. The committee hoped in the course of a few months to be able to make arrangements for the establishment of the second station at Speyside, where the forests were pure Scotch fir of a



magnificent growth. To meet the outlay, the committee required a renewal of the grant of £20.

Dr. Hooker, F.R.S., said that in the list of instruments which the committee proposed to use he had not heard thermometers for earth temperature mentioned, he thought that most important, and he also thought the area somewhat small.

Mr. G. J. Symons quite agreed with Dr. Hooker that the proposed experiments would be incomplete without earth thermometers which would indicate both the temperature, and humidity of the soil. He, however, was astonished at the proposal of the committee. The subject was one of great importance, which had been attacked by Becquerel, and still more ably by the Hon. G. P. Marsh, in his splendid work, "Man and Nature." Mr. Symons was evidently of opinion that the proposal of the committee was on far too limited a scale; he did not deny that some results might be obtained, but he felt sure that on fuller consideration the committee would bring forward some proposal more worthy themselves and of the importance of the subject.

#### REPORT OF THE UNDERGROUND TEMPERATURE COMMITTEE.

This report, read by Prof. Everett, the Secretary of the Committee, was mainly a statement of continuous rather than striking progress. Details of correspondence with parties in various quarters of the world who have undertaken to assist were given, some of those most popularly interesting being the great tunnels of Mont Cenis and St. Gothard, although to us the scientific value of results from such districts appears much less than from great depths in more level countries, and we are glad to find that though the Committee encourage the former they do not neglect the latter.

Mr. W. Sissons asked whether as the depth increased the temperature rose?

Professor Everett said that it did, but the rate of increase varied in different places, being as low as  $1^{\circ}$  Fahrenheit in 100 feet in a few cases, and at a great number of places about  $1^{\circ}$  in 50 feet.

The President said that two sources of complication existed, affecting an accurate record of the temperature. In sinking the thermometers down into deep wells they might disturb the temperature, for the thermometers were sunk into a liquid, and consequently, as the liquid strata of different temperatures superposed each other, they were sure to be always mixing more or less, and thus a very reliable indication could not be obtained of the spot to which the thermometer had been sunk. It was a difficulty he supposed that would be acknowledged.

Professor Everett replied that it was so, but such disturbance was very small and calculations were made to provide as far as possible against error. Even if the temperature increased by one degree per foot, instead of one degree for fifty or a hundred feet, the difference in density would only amount to one fifty-thousandth part, and therefore the amount of motion caused by it would be very small.

In answer to another question, Professor Everett said the temperature of the water at the top was always colder than at the bottom.

#### REPORT OF THE LUMINOUS METEOR COMMITTEE.

Shooting-stars and large fireballs have appeared during the past year in more than usual variety. Large meteors have presented themselves in considerable numbers, and ordinary shooting-stars in a more striking manner as regards the explanation of their origin than has been the case in former years. Of both these kinds of shooting-stars, both large meteors and meteoric showers, much accurate information has reached the committee; but the extent of the knowledge acquired on all hands, has at the same time advanced so rapidly, that a smaller amount of attention has this year been directed towards the discussion of the individual descriptions, than the committee have hitherto bestowed upon them. A more complete reduction of the separate observations will be attempted when the opportunities of the committee allow.

Those meteors, however, which have been observed simultaneously at more than one observing station have been selected from the collection for transcription in suitable columns in this report, and a list of large meteors is added, among

which some have occurred that have without doubt been noticed, and may have attracted attention in other directions. Two of the largest fire-balls seen in Great Britain were aërolitic, or burst with the sound of a violent explosion on November 3rd, at 5.30 p.m., and February 3rd, at 10 p.m. The first passed over the central part of Scotland, and the second burst over Manchester and its neighbourhood. Aerolitic meteors and aerolites have also been noticed in the scientific journals of other countries, which have given rise to experiments on the composition of aerolitic substances, both chemical and microscopical, the conclusions of which continue to extend the range of our speculations regarding the origin of these bodies. Thus the existence of carbon and hydrogen in the atmosphere from which the largest iron meteorite yet found (a few years since upon the shores of Greenland) was expelled, confirms the discoveries of Grahame and Professor Mallet, in America, of the existence of the same gases in other meteoric irons. Dr. Wöhler has thus detected the oxides of carbon as gases in the vast meteoric iron of Ovikaf found in Greenland, and brought to Stockholm during the last few years by Prof. Nordenskiöld, and the same gas was found by Prof. Laurence Smith in the siderite which fell recently in the United States. A connection between comets and meteorites appears to be indicated by these discoveries, for in the spectra of some of the former gases containing carbon appear to have been certainly recognised by Dr. Huggins.

The past year was distinguished by the occurrence of a most remarkable star shower on the night of November 27th, to the expected appearance of which astronomers were looking forward with especial attention from the unexplained absence of the double comet of Biela (to which it belongs) from its accustomed return in the last three of its periodical revolutions. The probability of the comet's path being marked by a meteoric stream into which the earth might plunge on or about Nov. 27 every year was already become a certainty, by the observation of such a meteoric stream on Nov. 30, 1867. On that night M. Zezioli, of Bergamo, observed a distinct star-shower, which, according to Schiaparelli, certainly belonged to the missing comet. Although the exact date of the shower could not be foretold with certainty from the want of recent observations of the comet, yet every probability was favourable to its reappearance last year, and those who awaited it, as well as many who did not, were surprised by the brilliant spectacle which it suddenly presented. At the first approach of darkness on the evening of the 27th of November, the cloudy state of the sky unfortunately deprived observers in the south of England of witnessing the sight, but in Scotland, and north of the Midland Counties of England many uninterrupted views of it were obtained. On the European continent and in the United States of America, as well as in the East Indies, at the Mauritius and in Brazil observers were equally fortunate in recording its appearance, and few great star-showers have hitherto been more satisfactorily observed, or indeed more abundantly described. In an astronomical point of view the agreement of the time and other circumstances of its appearance with the supposed path of the lost comet is so exact as to prove that the calculations made by astronomers of that comet's orbit cannot be affected by any errors of a large or sensible amount, and proof almost certain is thus obtained that the disappearance of the comet is owing to no unexplained disturbances of its path; but that like some former comets of variable brightness, it has not improbably faded for a time out of view, and that at a future time a reasonable expectation may be entertained of re-discovering it pursuing its original path in repeated visits to the earth's neighbourhood, and to the field of telescopic observation.

Only partial views of the ordinary periodical meteor showers of December, January, and April last were obtained, of which some descriptions are contained in the Report.

Reductions of the scattered meteor-observations on ordinary nights of the year are an important subject of the Committee's inquiries, which have been kept in view in their operations of the past year. Captain Tupman having obligingly placed a list of nearly 6,000 such observations (made by himself) at their disposal, the greater part of which he has reduced to their most conspicuous radiant points, the present purpose of the Committee is most effectually obtained by the publica-

tion of the valuable meteor list which has thus unexpectedly come into their possession; and a graphic projection of the radiant points has been prepared, which will be printed as an illustration of the copious information that will be gathered by observers from the contents of Captain Tupman's list. The catalogue will be distributed this year to observers interested in the research; and to enable suitable lithographic charts to be added to it, it is hoped that the members of the British Association will assist the Committee with such liberal communications of their observations as they have hitherto abundantly supplied.

### REPORT OF THE RAINFALL COMMITTEE.

Your Committee are glad to be able to report steady progress in the various branches of rainfall work under their supervision. The new stations started in Scotland, as explained in our last report, have, with few exceptions, been carefully attended to. Your Committee desire to record their thanks to the Directors and Secretary of the Highland and Dingwall and Skye Railways for the very great assistance already afforded, and which your Committee hope to render still more valuable by the personal inspection of the Stations by their Secretary at an early date. Gauges have been established at, and continuous records have been received from, upwards of 25 stations on these lines. Your Committee regret that the vicinity of the Caledonian Canal, and the West of Ireland are still very destitute of observers, and that several Welsh counties, *e.g.* Cardigan and Carmarthen, must be added to the list of districts in which observers are especially needed. Your Committee do not, however, enlarge upon this subject on the present occasion, because they hope at an early date to present a revised edition of the list of stations published in the Report of this Association for 1865, and such remarks will be more appropriate then than now. The list published in 1865 has, mainly in consequence of the development of the work under the auspices of the Committee, become obsolete, as it does not contain more than two-thirds of the data now collected. The new list will contain all records known at the date of publication, and will be invaluable to future enquirers.

The whole, nearly 2000, of the forms of enquiry respecting the positions, &c., of the rain gauges in the country were issued last October. Of these about 750 were not returned, and therefore at their meeting in June of the present year the Committee instructed their Secretary to send a second application to each of these persons; by this means many more have been obtained. The total number received up to the present time is 798. The returns have been sorted, the angular elevations of surrounding objects computed, blank forms prepared, and the tabulation has been commenced on a plan of which a specimen was shown. Although the mass of information thus procured is so large, the Committee cannot but regret that a considerable number of the forms have not been returned, and that it seems probable that those who have neglected to send them back are the persons respecting the positions of whose gauges information may be most desirable. Your Committee therefore feel that there is no alternative but to press forward the personal examination of all these stations as rapidly as possible. It is satisfactory to them to find that the views which they have steadily held of the paramount importance of personal inspection of the stations have not only been recognized and acted upon by the Meteorological Committee of the Royal Society, but have met with great support upon the Continent. At the meeting of the French Association for the Advancement of Science, at Bordeaux, September, 1872, the following resolution was passed:—"We think that rules universally applicable can be laid down for the verification of instruments, and the inspection of Meteorological stations, and we believe that it would be one of the greatest advantages which can possibly be realized in Meteorology." The same subject was discussed at the Meteorological Conference held at Leipzig, in August last, and the following resolution was adopted:—"It is desirable to make a periodical inspection of the stations of each system as frequently as possible." In consequence of the issue of the position forms previously mentioned, our Secretary has been obliged, both by considerations of time and money, rather to curtail these personal examinations, the number described in the appendix to the present report is however 63, bringing the total up to 486, to

which should be added those tested by Mr. Buchan with the apparatus presented to the Scottish Meteorological Society last year; of which, owing to Mr. Buchan's absence at Vienna, the details have not yet been received.

It will be remembered that the gauges erected in certain parts of Wales, and those erected in East Cumberland and Westmoreland, by Mr. Symons, in 1865, were transferred to this Committee some years back. As some of the observers have died, and some of the gauges have been disabled, your Committee have directed their Secretary to go over the district, and re-arrange them as may seem most expedient.

The experimental gauges erected some years since at Calne, at the expense of Colonel Ward, and subsequently removed to Strathfield Turgiss and Hawsker, and of which the results were reduced, presented to this Committee, and by them inserted in their 1869 and 1870 reports, have been finally dismounted, and preserved for future use, if required, it being considered that the points which they were constructed to test have been thoroughly investigated.

During the decennial period extending from 9 a.m. January 1st, 1860, to the same hour on January 1st, 1870, there were 317 records of rainfall kept in the British Isles, without the omission of a single shower. These records therefore give 38,040 monthly values, or 3170 values for each month of the year, and afford by far the most reliable basis for investigation into the seasonal distribution of rainfall ever yet available. Accordingly your Committee have had them all converted into per-centages of the yearly totals at the several stations, and tabulated in the same manner as those for previous decades, given in our report for 1868. We give on the present occasion the per-centages for each individual station, because it has been remarked that we have not given monthly averages, and the per-centages are readily reconvertible into monthly means by a simple process explained by the Committee. They also give the means for each group, and, for comparison, the corresponding values for the previous decade, 1850-59, and also the departures of each group from the mean of each district. These values strengthen the evidence which we adduced in the 1868 report of the greater relative wetness of winter months at Western stations, and especially at those of large rainfall. But though they corroborate the fact of the oscillation, they rather reduce its amount. It is satisfactory to find that the general inferences drawn by Mr. Gaster, and quoted in the 1868 report, are so far corroborated by the fuller information now obtained, that, except as hereinafter noted, we may refer to that report as giving a fair *resumé* of the facts in the present, always remembering that the 1860-69 decade has shown the various features in a less marked degree than the decade 1850-59.

In order to facilitate an accurate determination of the months in which the maximum and minimum rainfall usually occur, we have compiled other tables, which give the months of maximum and minimum respectively for two complete decades, for England, Scotland, and Ireland, adopting the same sub-division into districts, and grouping according to amount of annual fall, as in the previous tables.

The essential difference between the two decades is, that in 1860-69 July as a month of maximum rainfall has disappeared altogether, and April has become more frequently that of the minimum. In fact, during the last ten years April has been the driest month at most stations in the British Isles, while in the previous decade this distinction was pretty equally shared by February and May.

With a view to determining whether "the same relative monthly values are found at the same station in all decennial periods" the Committee selected 17 registers, each extending over at least 40 successive years, while 4 extended over 50, and 1 over 60 successive years, and reduced them in the same manner as the 1860-69 values. These are given in a table, and the result can hardly be called satisfactory: they show the same general features as the two decades which have been discussed in detail, such as the larger per-centages in winter months in wet district, and in the summer and early autumn in dry districts, but the months of maximum and minimum shift about to an extent which would not be expected considering that each value represents the average of ten years.

An examination of these records, all embracing more than one-third of a century, proves that however steady the ten yearly average amount of rain may be, its

distribution over the months in not so by any means, so that as far as our present investigations go it is impossible to lay down any general law as to the precise month of maximum and minimum fall.

The rainfall of 1872 was so excessive that the Committee, although in accordance with previous practice, postponing full discussion of its peculiarities until 1874, instructed their Secretary to offer a few remarks upon it after the conclusion of the Report.

Mr. Symons then proceeded to describe, by the aid of large maps, the principal features of the rainfall of 1872, and explained that while the total annual rainfall usually ranges within one-third above or below its mean amount, there were in several separate localities instances of excess of not 33, but 60, 70, and even 77 per cent., all of these being absolutely without precedent during at least 148 years.

The President said that it appeared from the map that in Westmoreland, usually one of the wettest districts, the excess in 1872 had not been proportionally great. Had it been otherwise the district must have been completely drowned out. The wind seemed to have been tempered to the shorn lamb.

Mr. Symons said it was quite true that the excess at the very wet stations had been much less in proportion than elsewhere. Had it been otherwise the fall at the wettest station would have been, within an inch or two, 25 feet—say 290 to 300 inches.

# ON AN IMPROVED FORM OF ANEROID FOR DETERMINING HEIGHTS, WITH A MEANS OF ADJUSTING THE ALTITUDE SCALE FOR VARIOUS TEMPERATURES,

BY ROGERS FIELD, B.A., C.E.

The author begins by stating that the object aimed at in designing this improved form of aneroid was to simplify the correct determination of altitudes in cases such as ordinarily occur in England, and that the instrument is therefore arranged to suit moderate elevations, say of 2000 feet and under, and is not intended for considerable elevations.

Before proceeding to describe this instrument, he briefly recapitulates the general principles on which the measurement of heights by a mercurial barometer depends, and for this purpose he refers to the mercurial barometer as the original source from which the graduations on the aneroid are obtained. If an observation taken at one station is compared with that taken at a higher one the difference of the readings of the barometer will give the height of mercury which balances the column of air between the two stations, so that knowing the relative weight of air and mercury we can determine the height of the column of air, or, in other words, the vertical height between the two stations. The relative weights of air and of mercury are variable, being affected by the gradual reduction of the pressure of the air as we ascend, and also by variations of temperature; the accurate determination of their relative weights is the principle which lies at the basis of the various formulæ that have been proposed for barometrical measurement of altitudes, although the problem cannot be stated in such a simple form as this.

The preceding general principles apply to the aneroid equally with the mercurial barometer. A good aneroid is always graduated by direct comparison with a standard mercurial barometer, so that the readings of the aneroid represent those of a mercurial barometer, and the better the aneroid the more accurate this representation will be. A well constructed aneroid, however, differs from a mercurial barometer by being compensated to a certain extent for the effect of the temperature on the instrument itself, so that this need not be taken into account, more especially as the effect of temperature on the instrument only becomes important when the temperature of the station differs considerably, which it will not do in moderate elevations.

The conditions, therefore, which have to be taken into account in the present case, are, 1st. the pressure of the atmosphere, and 2nd. the temperature of the air.

Various formulæ are given by different authorities for determining the altitude readings of the barometer, but they do not differ much for small altitudes, though this is far from being the case with great altitudes. The table which is adopted in

graduating the present Aneroid is that given by the Astronomer Royal in the "Proceedings of the Meteorological Society, vol. iii., page 406," and gives results which lie between those of the other authorities.

Aneroids constructed for the determination of elevations by readings from an altitude scale consist of two classes, one in which the altitude scale is fixed, and the other in which it is movable at random. The first class of aneroid with a fixed scale is accurate in principle, but the scale only allows for one of the conditions which have to be taken into account, viz., the varying pressure of the atmosphere, and the other condition, or temperature of the atmosphere, has to be allowed for by calculation. The second class of aneroid, that with a movable scale, is radically wrong in principle as ordinarily used, inasmuch as the movable scale must be graduated from one fixed position of the zero, and when the zero is shifted at random according to the position of the hand of the instrument, the scale necessarily becomes inaccurate.

In the improved aneroid the scale of altitudes is movable, but instead of being shifted at random according to the position of the hand of the instrument, it is moved into certain fixed positions, according to the temperature of the atmosphere, so that the shifting of the scale answers the same purpose as if the *original* scale were altered to suit the various temperatures of the atmosphere. The aneroid is graduated for inches in the usual way on the face, but the graduation only extends from 31 to 27 inches, so as to preserve an open scale. The outer movable scale is graduated in feet for altitudes, and the graduation is laid down by fixing the zero opposite 31 inches. This is the normal position of the scale, and it is then correct for a temperature of  $50^{\circ}$ . For temperatures below  $50^{\circ}$  the zero of the scale is moved below 31 inches, and for temperatures above  $50^{\circ}$  the zero of the scale is moved above 31 inches; the exact position of the zero for different temperatures has been determined partly by calculation, and partly by trial, and marked on the rim of the aneroid. In order to ensure the altitude scale not being shifted after it has once been set in its proper position, there is a special contrivance for locking it in the various positions. The altitudes are in all cases determined by taking two readings, one at each station, and then subtracting the reading at the lower station from that at the upper.

The movable scale requires to be set for temperatures before taking any observation, and not shifted during the progress of the observations. This will practically not give any inconvenience in the case of moderate altitudes, as small variations of temperature will not appreciably affect the result, and so long as the temperature does not vary during the course of the observations more than  $6^{\circ}$  or  $8^{\circ}$  from that at which the instrument is set, the result may be accepted as practically correct.

In conclusion, the author states that the principle of allowing for the variations of temperatures of the atmosphere by shifting the altitude scale does not profess to be theoretically accurate, but simply sufficiently accurate for practical purposes. In order to satisfy himself that this was the case, the author carefully tested the aneroid by comparing the readings obtained for different temperatures from the shifted scale with the correct readings as given by calculations from the normal position of the scale, and found that the maximum error was 8 feet, and the average error under 3 feet, errors which are practically inappreciable.

The instrument was constructed by Mr. Casella, of Holborn Bars, London.

In the short discussion which followed, and in which Prof. Everett, Mr. Glaisher, Mr. Symons, and Mr. Whipple took part, general approval was expressed of the arrangement.

*(To be continued.)*

## THE HEAT AND THUNDERSTORMS OF JULY 22ND.

*To the Editor of the Meteorological Magazine.*

SIR,—In your articles on the heat and thunderstorm of the 22nd July, in the last two numbers of the "Meteorological Magazine," I do not see any returns from Cumberland. If not too late I will now

supply the omission. Monday, the 21st July, was a very fine warm day, the maximum temperature in the shade being  $82^{\circ}0$ . The following day was much hotter, the maximum in the afternoon being  $89^{\circ}1$ . This, with two exceptions, is the highest temperature observed here during the past twelve years. The exceptions were 25th July, 1870, and 4th August, 1868. On the former of these dates the thermometer registered  $89^{\circ}4$ , and on the latter  $89^{\circ}3$  in shade. About 5 p.m., on the 22nd, distant thunder was heard in the S.E.; and from that time till about 9 p.m. thunder and lightning were almost incessant, apparently from nearly all quarters of the heavens in succession. There was not during this time much rain. Thunder and lightning occurred again early on the morning of the 23rd, commencing before 3 o'clock and continuing till near 5 o'clock. This storm was accompanied by heavy rain, 0.675in. being in the rain gauge at 9 o'clock that morning.

I have not heard of any damage being done by the lightning in this neighbourhood.—I am, Sir, yours, &c.,

H. DODGSON, M.D., F.M.S., &c.

Cockermouth, Cumberland, Oct. 7th, 1873.

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*To the Editor of the Meteorological Magazine.*

SIR,—In your magazine for this month you express a doubt whether the TS at Liverpool, on July 22nd, is the same as that on the S.W. of Scotland. I was then at New Brighton, and will tell you what I saw, premising that I did not at the time take memoranda, and must therefore trust to memory.

L and T began about  $5\frac{1}{2}$  p.m., coming up from the W.S.W. This storm was not such as actually to produce rain, but the L was very vivid and almost constant, forked and not far distant. This passed off northward, before  $6\frac{1}{2}$  p.m., and very probably is the storm that went to the north of Scotland—its direction being quite that way.

Another came up soon after 6 p.m., say about  $6\frac{1}{4}$ , from the south—I think along the Cheshire side of the Mersey, *certainly not from Liverpool*, but owing to the steep hill in that direction behind me, I could not precisely give the point of the compass. This continued until about 8 p.m., it began to rain about 6.35. L and T very vivid and near. This passed over to N.E. For more than one hour the street opposite to me was quite impassable. A perfect torrent of water was rushing down it—an occurrence *most* unusual at New Brighton, for the sand there will immediately absorb almost any amount of rain.

The storm over Liverpool was quite distinct from this, and did not commence until later—some time after 7 p.m.

I will not assert that the storms were originally and entirely distinct, most probably they were one at their first origin, but certainly they appeared at New Brighton as three, in the way above mentioned.

Yours very truly,

ALFRED NORTH.

September 16th, 1873.

## THE VIENNA CONGRESS.

[It is satisfactory to notice the much greater promptitude with which the proceedings at Vienna have been reported than that manifested at Leipzig. Proofs of the discussions were received in this country before the delegates had returned, and the following resumé appeared within a fortnight of the close of the Congress. We have no doubt that our readers will (even if they read it in the *Times*) be glad to have it in a permanent form.—Ed.]

## THE METEOROLOGICAL CONGRESS AT VIENNA.

*To the Editor of the Times.*

SIR,—It may be of interest to some of your readers to have a brief account of the proceedings of the recent Congress at Vienna.

Delegates were sent from every European Government except France, but those from Spain and Greece were unable to attend. In addition the United States and China were represented, the latter through the Customs Department. The British Colonies were unable to send delegates, owing to distance, &c. In all, about 40 members were present.

The proceedings were formally opened on the 2nd of September by Dr. C. von Streymayr, Minister of Public Instruction, and were continued daily until the 16th. The protocols of the meetings are in the press, and will appear officially in German and French, while I have undertaken to public an English translation as soon as practicable.

It is not possible to give a full account of the proceedings before the appearance of the report, but some short notes of the most important practical decisions may not be uninteresting to the general public.

Temperature.—No recommendation was made as to the exposure of thermometers, the question being too difficult for solution at present. The *maximum* or [and? Ed.] *minimum* thermometers are always to be read at the latest observing hour in the evening, and the readings put down to the day on which they are made. Certain combinations of hours are laid down as admissible for thermometrical observations.

Wind.—It is proposed to use the Swiss hinged plate as a cheap instrument for measuring the force of the wind, as a substitute for the simple estimation of that force, which is generally fallacious unless when it is made by seafaring men.

Rain.—To be measured in the morning and put down to the previous day. The gauge to be about 8 in. diameter, and at a level of one yard, or, better, 1½ yard above the ground.

Ozone, atmospheric electricity, and some other elements are excluded from those which are to be necessarily observed at ordinary stations.

Means are to be taken for local time, civil days, months, and years, and for Lustra (five year periods), beginning 1876; and also for temperature only for the 73 five-day periods.

Storm warnings.—It is recommended, while abstaining from direct prophecy, to give an indication, by signal, of the probable direction of the wind which may blow.

An elaborate paper on this subject, by Dr. G. Neumayer, will be published with the report, together with extracts from the replies received to a circular issued by him, Professor Buys Ballot, and myself last spring.

The Congress agreed to adopt a proposal made by Gen. Myer on behalf of the United States' Government, with reference to the establishment of a system of really simultaneous meteorological observations over the globe, for the purpose of facilitating weather study. It is not possible now to obtain simultaneous observations for weather charts over an extensive area in Europe. An effort is to be made to induce as many observers as possible all over the globe, to record one single set of observations daily at a fixed epoch of Greenwich time; The signal service of the United



States undertaking for its system the Meridians where the observation hour will fall during the night time.

These observations are to be recorded so as to be in existence for future weather study, but not to be sent by telegraph unless the recipient bears the entire cost of such transmission.

Lastly, a Permanent Committee, consisting of MM. Buys Ballot, Bruhns, Cantoni, Jelinek, Mohn, Scott, and Wild, has been appointed to watch over the progress made towards uniformity in observation, &c., and to make arrangements for the assemblage of another Congress in three years. This Committee will publish annual reports.

I may express the hope that several of the above decisions will be found useful for the progress of our science. It must, however, be clearly understood that the notes I have given are only my own recollections, aided by uncorrected proofs of the protocols, and are not authoritative in any way. The reports in the Vienna papers were incorrect, so that I did not think it worth while to send them to London.

It only remains to notice the cloud which has fallen on us since the Congress broke up. Professor Donati, one of the most active of the members there, has, I cannot doubt it, fallen a victim to the climate of Vienna. He felt it seriously, as all of us did, and the day before he left he spoke often to me of his wish to get away, and he left before our sittings closed. It was then too late for him—the mischief was done—and he died of cholera soon after reaching Florence. The only wonder to me is, that his was the only death among our number.

Your obedient Servant, ROBERT H. SCOTT.

September 29.

## REVIEW.

*Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, June 7th, 1873, 4to.*

It may be convenient to many of our readers to have an epitome of the statements in the above which bear most closely upon meteorology:—

A railed platform has been erected over the roof of the Magnetic Observatory, to facilitate observations of shooting stars \* \* \*

The temperature of the magnetic basement is still maintained, as during past years, in almost perfect uniformity \* \* \*

The question may perhaps be considered whether chronographic registration should be introduced for sudden meteorological phenomena, such as shooting stars, auroral beams, &c. A small portable chronograph adapted to mechanical registration, which the observatory possesses, appears likely to be suitable for these observations \* \* \*

The absolute measures of horizontal magnetic force are prepared to the end of 1872; the dips, as usual, are reduced to the last observation.

The following are the principal results for 1872:—

Mean westerly declination	...	...	19° 37', nearly
Mean horizontal force	...	...	{ 3·876 (in English units). 1·787 (in Metric units).
Mean dip	...	...	{ 67. 46. 15 (by 9-inch needles). 67. 47. 44 (by 6-inch needles). 67. 49. 35 (by 3-inch needles).

The vane of Osler's Anemometer made, in the year 1872, 3·0 complete rotations in the positive direction N, E, S, W.

Considerable progress has been made in the reductions of the photographic records of thermometers from 1848 to 1868. The diurnal changes of the dry-

bulb thermometer, as depending on the month, on the temperature waves, and on the barometric waves, have been computed and examined for the whole period ; and a considerable portion of the exhibition of results is ready for press. The similar reductions for the wet-bulb thermometer are far advanced. \* \* \*

A short meteorological report is sent daily by telegraph to the Paris Observatory, for insertion in the Bulletin. A morning report is also sent by post to the Paris Observatory, to the British Meteorological Office, to some post offices, and some newspapers ; and a report of the weather to 3h p.m. of each day is sent to three newspapers. The extremes of temperature during the 24 hours preceding 9h a.m., deduced from observations with the ordinary instruments, are exhibited to the public on a card, which is placed every morning below the public barometer. \* \* \*

Very lately, application has been made to me, through the Board of Trade, for plans and other information regarding time-signal-balls, to assist in guiding the authorities of the German Empire in the establishment of time-signals at various ports of that state. In other foreign countries (see Professor Langley in Silliman's Journal, 1872, November,) the system is extending, and is referred to Greenwich as its origin.

In Britain the demand for these signals has increased so much that a tariff of annual charges for time-signals, originating from this Observatory and circulated by the Post Office Telegraphs, is published in the "British Postal Guide," and exhibited at some post-offices. \* \* \*

In the important post-office of Lombard Street, the action of a galvanic current sent from Greenwich mechanically corrects the clock. At the Westminster Palace a signal is sent from Greenwich for the guidance of the attendant. Each of these clocks automatically sends us signals to acquaint us with its state. The errors of the Westminster clock were below 1s on 67 per cent. of days, below 2s on 96 per cent., and below 3s on 99·6 per cent. \* \* \*

As regards the future probable history, there is one matter which has gradually been forcing itself on my attention, and which I think may ultimately bring on an extensive change in the personal arrangements of some observatories, namely, the increase of facilities for making observations. This applies principally to magnetical and meteorological observations. The inevitable result of it is, that observations are produced in numbers so great that complete reduction becomes almost impossible. At the time of making the observation, reduction such as can then be effected is rather annoying ; and when the reduction is long deferred, the amount of work to be done is sufficient to dishearten even a resolute computer. In former years I have felt this in some measure in regard to magnetical observations which, however, I have succeeded in reducing in two long periods of years, and of which the results, as I trust, possess considerable value. In the last few years, I have entered vigorously upon the reduction of 21 years' photographic registers of the thermometers ; but the labour has been very great, far greater than, upon a hasty examination, I could have conceived ; and some time must yet elapse before the reductions can be carried out to the extent which I contemplated. Yet until this, or at least a large part of it, is done, the rich store of observations is useless.

Of the enormous number of meteorological observations now made at numerous observatories, very few can ever possess the smallest utility.

It may soon be necessary to alter the proportion of the two great sections of an observatory establishment ; perhaps to diminish the observing power, certainly to increase the computing power. It is even conceivable that it may be found political to refer the computations to a national computing establishment. I do not, however, urge these matters as requiring immediate action ; I merely desire to record ideas which may possibly have their influence in guiding future arrangements.

G. B. AIRY.

*Royal Observatory, Greenwich, 1873, May 22nd.*

SEPTEMBER, 1873.

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.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.			Min.					
				Dpth.	Date.	Deg.	Date.		Deg.	Date.				
I.	Camden Town .....	2.46	+	.20	.93	14	11	72.0	27	40.3	22	0	0	
II.	Maidstone (Linton Park).....	2.69	+	.47	.87	15	14	76.0	27	40.0	22	0	0	
III.	Selborne (The Wakes).....	3.19	+	.75	1.00	14	14	69.0	1	33.0	27	0	2	
IV.	Hitchen .....	2.49	+	.63	.49	14	14	66.0	1	35.0	21*	0	...	
V.	Banbury .....	1.49	—	.88	.25	9, 10	14	68.0	27	32.0	29	1	...	
VI.	Bury St. Edmunds (Culford).....	2.72	+	1.11	.65	14	13	69.0	20	30.0	28	2	4	
VII.	Bridport .....	1.66	—	.66	.33	14	12	69.5	27	39.0	24	0	...	
VIII.	Barnstaple.....	3.16	—	.60	.48	14	20	75.5	28	41.0	24†	0	...	
IX.	Bodmin .....	4.14	+	.47	.92	7	22	67.0	20	45.0	23	0	0	
X.	Cirencester .....	1.10	—	1.76	.31	3	12	...	...	...	...	...	...	
XI.	Shiffnal (Haughton Hall) .....	1.43	—	.52	.40	13	14	67.0	1	32.0	29	1	...	
XII.	Tenbury (Orleton) .....	1.34	—	1.34	.47	13	12	72.5	27	29.0	29	1	1	
XIII.	Leicester (Wigston) .....	1.45	—	.76	.31	9	12	75.0	1	30.0	28	...	...	
XIV.	Boston .....	2.01	+	.44	.40	14	12	73.0	27	37.0	22‡	0	...	
XV.	Grimsby (Killingholme) .....	2.45	...	...	.72	15	14	69.0	2	35.0	30	0	...	
XVI.	Derby.....	1.58	—	.76	.47	13	14	70.0	27	35.0	29	0	...	
XVII.	Manchester .....	2.48	—	1.21	.53	9	17	75.7	27	33.0	29	0	2	
XVIII.	York .....	1.84	—	.49	.49	13	14	70.5	27	31.0	30	1	...	
XIX.	Skipton (Arncliffe) .....	4.49	—	.47	.86	9	19	70.0	26	26.0	27	3	...	
XX.	North Shields .....	2.16	+	.46	.44	30	15	68.0	27	37.2	30	0	...	
XXI.	Borrowdale (Seathwaite).....	13.70	+	.49	4.00	30	18	...	...	...	...	...	...	
XXII.	Cardiff (Ely) .....	3.19	—	.56	.60	8	16	...	...	...	...	...	...	
XXIII.	Haverfordwest .....	3.73	+	.02	.99	13	17	67.0	27	32.0	28	0	1	
XXIV.	Rhayader (Cefnfaes).....	2.71	—	1.13	.66	9	22	73.0	...	31.0	...	...	...	
XXV.	Llandudno.....	2.65	+	.31	.51	6	16	75.5	27	41.0	30	0	...	
XXVI.	Dumfries .....	2.82	+	.09	1.30	30	15	69.0	27	33.0	22	0	...	
XXVII.	Hawick (Silverbut Hall) .....	2.56	...	...	.84	30	18	...	...	...	...	...	...	
XXVIII.	Kilmarnock (Annanhill).....	5.86	...	...	2.35	30	16	69.4	28	33.8	7	0	1	
XXIX.	Castle Toward .....	5.34	+	.72	1.35	12	16	63.0	2	...	...	...	...	
XXX.	Leven (Nookton) .....	3.42	+	.94	1.04	30	20	75.0	27	34.0	7	0	6	
XXXI.	Stirling (Deanston) .....	4.02	+	.87	1.00	30	17	69.8	27	31.0	7	2	4	
XXXII.	Logierait .....	3.31	...	...	.63	30	14	70.0	27	33.0	21	...	...	
XXXIII.	Braemar .....	6.67	+	4.03	3.31	14	22	68.3	24	35.0	29	0	6	
XXXIV.	Aberdeen .....	3.94	...	...	.89	14	22	69.2	1	35.5	22	0	3	
XXXV.	Inverness (Culloden) .....	5.57	...	...	.89	15	21	67.8	27	41.0	30	0	4	
XXXVI.	Portree .....	4.12	—	6.64	1.01	10	26	...	...	...	...	...	...	
XXXVII.	Loch Broom .....	5.07	...	...	1.04	15	21	...	...	...	...	...	...	
XXXVIII.	Helmsdale .....	5.49	...	...	.87	10	26	...	...	...	...	...	...	
XXXIX.	Sandwick .....	3.51	—	.15	.48	17	19	69.0	27	38.0	9	0	1	
XL.	Caherciveen Darrynane Abbey .....	6.59	...	...	1.16	14	21	...	...	...	...	...	...	
XLI.	Cork .....	...	...	...	...	...	...	...	...	...	...	...	...	
XLII.	Waterford .....	3.39	+	.26	1.39	14	20	66.0	17	38.0	29	0	...	
XLIII.	Killaloe .....	5.26	+	1.10	1.85	30	16	67.0	24	35.0	22	0	...	
XLIV.	Portllington .....	1.76	—	1.52	.67	14	19	68.0	1	30.0	28	1	...	
XLV.	Monkstown .....	2.08	+	.09	1.28	13	12	...	...	27.0	28	2	2	
XLVI.	Galway .....	4.14	...	...	1.32	29	14	71.0	22	32.0	6	1	...	
XLVII.	Bunninadden (Doo Castle) ...	2.42	...	...	...	...	...	...	...	...	...	...	...	
XLVIII.	Waringstown .....	2.72	...	...	1.02	30	17	71.0	24	33.0	21	0	1	
XLIX.	Edenfell (Omagh).....	4.13	...	...	1.52	30	18	65.0	27	30.0	21	3	...	

\*And 28. †And 29. ‡And 29. ||And 30.

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

## METEOROLOGICAL NOTES ON SEPTEMBER.

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

## ENGLAND.

LINTON.—First half of the month dull, cold, and wet; the latter half very dry and fine, the 20th, 25th, 27th and 28th very warm and bright, and more like July than September; no high winds, and (notwithstanding the heavy R on the 8th, 14th and 15th, amounting to nearly two inches) the ground at the end of the month was very dry, so that on the whole it may be recorded as a favorable month.

SELBORNE.—On 14th heavy and repeated showers; 25th, frost on the low ground; fogs on 26th, 27th, 28th and 30th; frost on the grass on 26th and 27th; prevailing winds W. to S.W. during the first half of the month; harvest much retarded by wet weather.

BANBURY.—TS at 11.30 a.m. on 3rd; 8th and 14th, high winds; 26th and 27th, fog.

CULFORD.—T on 1st, 2nd, 14th and 15th, and a heavy fog on the morning of 25th; preternaturally cold weather set in about the commencement of the month and R fell more or less on nearly every day until the 15th, after which no rain fell, and the weather became remarkably fine, the max. temp. of the month 69°, and the mean of the month 51°·2, both being below the average.

BRIDPORT.—Wet till 16th; very fine during the remainder of the month; all the corn gathered.

SHIFNAL.—The weather, previously so detrimental to the harvest, continued through the first half of this month, and the crops were with difficulty secured, all being more or less damaged. Those deferred to the latter end fared better; rain almost daily till the 17th, with low temp., the max. never exceeding 62° after the 1st when it was 67°; the wind varied from N.W. to S.W. up to the 25th, when it changed for three days to S.S.E., then back to N.W.; T in S. at 1 p.m. on 15th, with heavy R, dense fog on 26th; bar. on 22nd 30·17, the highest since February 18th; potatoe crop abundant but much diseased, not a mushroom here.

ORLETON.—The first half of the month was generally cloudy, with frequent falls of R and little sunshine, the latter half was dry and favorable for the harvest, with a fair proportion of bright days. The temp. of the whole month was more than 2° below the average, and lower than that of any September since 1863. A very severe frost occurred on the morning of the 29th. Distant T was heard on 3rd and 15th, and L seen on the night of the 1st. No great wind; bar. at 9 a.m. on the 22nd stood at 30·35.

BOSTON.—TS on 2nd, 3rd and 14th; very foggy on the morning of the 26th; temp. of the month 48°, being below the average. The harvest for white corn finished by about the 19th; first part of the month very wet, but continuous fine weather from the 15th to the end, which will be of incalculable value to the potatoe crop, and for preparing the land for wheat seed, &c.

GRIMSBY.—L at 10 p.m. on the 2nd; TS and R at 3 p.m. on third. Rime for the first time on the 22nd; beautiful weather from the 18th to the end. The harvest better got in here than in many places; good crops on the wolds, a light yield on the clays; potatoes better than for many years past.

DERBY.—The latter part of September has been charming, more like summer than we have had this year. The bar. readings were excessively high, on the 22nd it was 30·36, or corrected for sea level 30·54; with the exception of a few days in February last, the pressure has not been so great since January, 1870. Mean temp. 3° above the average.

MANCHESTER.—TS on 3rd and 14th.

ARNCLIFFE.—TS on 14th.

NORTH SHIELDS.—TS on 14th.

SEATHWAITE.—TS on 9th and 11th; T on 14th; L on 10th; 4·00 in. of R fell on 30th.

## WALES.

HAVERFORDWEST.—The first half of the month resembled the weather of the preceding one, the latter half was fine, with easterly winds and clear sky, and

proved eminently favourable to the saving of the harvest, which appears not to have suffered so much as was feared.

CEFNFAES.—Prevailing wind during the month N.W., nights generally frosty.

LLANDUDNO.—3rd, TS during the night; 7th, remarkably clear, the Isle of Man visible, on the 8th still more so, Liverpool and the Isle of Man both seen distinctly. On the 14th several slight showers, otherwise fine; 15th, stormy till noon then fine till 3.30, when there was a peal of T and E. At 1.30 p.m. on 27th the difference between the wet and dry ther. was  $14^{\circ}$ , the dry being  $75^{\circ}$ , the wet only  $61^{\circ}$ .

#### S C O T L A N D .

DUMFRIES.—First two days showery, then fine to the 9th, from that to 20th showery, then fine to the close. But for the heavy fall (1'30 in.) on the 30th, the rainfall of the month would have been much below the average. Mean temp.  $1^{\circ}\cdot7$  below the average; T on 11th and 14th. The weather on the whole favorable for harvest work, and crops in this district were secured generally in capital condition. The produce much greater than anticipated; potatoes much diseased, the injury varies from a third to two-thirds diseased.

SILVERBUT HALL, HAWICK.—A cold and (with the exception of nine fine days at the end) wet month. Very fine lunar rainbow on the night of the 5th, followed by three fine days and frosty nights; T and much L on the night of the 14th. Potatoe disease very general in this district.

ANNANHILL.—Rainfall heavy, 2'35 falling on the 30th; from the 4th to 8th and from 20th to 26th were dry, and farmers had good weather for carrying their grain, but the late heavy rains have put a stop to that for the present; very little grain uncut in this neighbourhood. Winds principally westerly, light to moderate. Evening of 18th gale from W.N.W., with pressure, during some of the squalls, of 20lbs. to the square foot, and travelling at the rate of 70 miles an hour at 7 p.m., the gale being accompanied by T, L, E and H. Ozone well developed; the month generally unhealthy; typhoid fever very prevalent. Death rate 29 per 1000. In a note the observer says on Oct. 1st '90 in. fell, on the 2nd '80 in., and on the 3rd that the E showed no signs of abating, that they had had tremendous floods in Ayrshire, and the rivers were very large.

CASTLE TOWARD.—Prevailing winds W. and N.W. Great flood on the 12th and also on the 21st; on 22nd and 23rd gales from N.W. Harvesting operations commenced early; the month throughout has been anything but favorable, and every glimpse of sunshine has had to be taken advantage of; the whole of the grain has been cut, and our barnyards begin to have a cheering appearance, the yield generally is splendid in this locality. Potatoe disease continues; turnips never looked better. Sheep and cattle healthy and pasture still abundant.

DEANSTON.—Weather still unsettled and rainy; fickle for the harvesting of the cereal crops, which are fine in quality and weigh well, a good deal still standing out, both cut and uncut.

BRAEMAR.—In general a dark month, unfavourable for the ripening of the corn; snow on the hills on the 7th; TS with very heavy E in the evening of 14th, fall in the 24 hours, 3'31, being the largest amount recorded at this station since its establishment in 1856. L on 26th and 27th. Total fall of the month 6'67, being 4'03 above the average.

ABERDEEN.—Bar. pressure and temp. rather below the average, rainfall considerably above it. The earlier part of the month cold and unusually wet, the latter part fine and warm. On the 15th there were unusually heavy floods in the Dee and the Don; said to have been the highest since August, 1829. At bridge of Dee, Aberdeen, the water marked 10 feet on the piers, and reached the spring of the arches. Large quantities of corn swept from the haughs. Lunar rainbow at 8.50 on 7th; frequent silent lightning and occasional distant thunder.

PORTREE.—A very squally month; heavy H showers on 18th; hills coated with snow on the 30th; very damp throughout, only four days without E, and yet there has less fallen than in any September since the register began in 1860. A strong gale from the S. on 27th and 28th. Harvesting much retarded by the showery weather, nearly half the corn cut, but only a little carried to the stackyard, but we trust to the Highlanders' harvest month, viz., October. Cattle and sheep thrive well on the pastures.

LOCHBROOM.—Except the week between the 22nd and 29th, we had not a propitious day for the harvest in the whole month; much corn is still out, and indeed there is a good deal yet uncut. There was an excellent crop had it been well secured, but it has sustained much damage. The green crops and grass are excellent, and there is no disease here in the potatoes.

#### I R E L A N D.

DARRYNANE ABBEY.—Very heavy R on the 14th from 10.30 a.m. to 4.30 p.m., the rest of the day and night showery, total fall in the 24 hours 1.16 in. Winds during the month variable, having been easterly from 3rd to 6th and 21st to 26th, rest of the month chiefly N.W. All this summer the N.W. winds have been accompanied by fogs, which I never remember before.

DOO CASTLE.—Remarkably fine month, the harvest has been got in in prime order.

WARINGSTOWN.—Unsettled until the 20th, when a fine week did much good here, but there is still much grain in stock and some yet uncut.

OMAGH.—Although the rainfall of the month has been heavy, an abundant harvest has been secured in very fair order.

### SUPERPOSED CURRENTS AND CAPTIVE BALLOONS.

*To the Editor of the Meteorological Magazine.*

SIR,—An appearance worthy of notice has, I think, occurred here to-day, at 3 p.m. There were three strata of clouds, and each going exactly in the contrary direction.

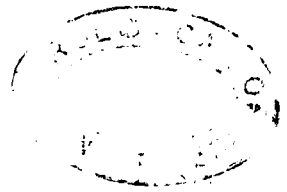
Surface Wind blowing to the North.
1st strata of Cloud going to the South.
2nd   "               "               "               North.
3rd   "               "               "               South.

Yours truly,

JAMES NUTTER.

*Granchester Mills, Cambridge, Oct. 9th, 1873.*

[The above is a remarkable case, exceeding even that quoted by Luke Howard, in his "Climate of London," Vol. II, p. 91, where he reports on Oct. 29th, 1809, four currents, viz: E.S.E., N., S.W., and S.S.E. We have added the last two words to the title because the above letter is closely connected with that subject, and we have often contemplated bringing before our readers the desirability of its renewed study. The British Association at one time granted funds for experiments with captive balloons, but they were of quite a different class to those mentioned by Luke Howard, and required for the purpose of detecting such phenomena as those mentioned above. The experiments designed (but, as far as we can ascertain, not carried out), and for which funds were granted by the British Association, were for the determination of temperature and other changes at one fixed altitude. We think something quite different is worth trial.—Ed.]



SYMONS'S  
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XCIV.]

NOVEMBER, 1873.

[PRICE FOURPENCE.  
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THE NEWBOTTLE WHIRLWIND OF NOV. 30TH, 1872.

By T. BEESLEY, F.C.S.

[We are sure that no words of ours are needed to explain the reason for the large space we devote to this subject. We are aware of no instance in which a similar phenomenon has been observed by so many persons, or their evidence so carefully and judiciously collected as it has been by Mr. Beesley in the present case. With the second portion of the narrative in our next, we shall present a lithograph from the plan which has been drawn with scrupulous accuracy, and perhaps (should there be a general wish to obtain them) we may be able to inform our readers of arrangements for supplying copies of the photographs. We postpone any further remarks until the conclusion of the narrative.—Ed.]

Saturday, November 30th, 1872, was a day remarkable for atmospheric disturbance. Thunder-storms occurred in many parts of England, with sudden gales of wind. The barometer fell rapidly; its reading at Banbury (5, High Street), 345 feet above sea level, was at

9 a.m. 28·607 at 32°  
3 p.m. 28·479 at 32°  
10·30 p.m. 28·359 at 32°

About 11 a.m. it became very dark, so that it was difficult to read a newspaper when sitting near a window. In a few minutes, hail, followed by rain, fell sharply, and in the midst of it came a single flash of lightning, instantly followed by crashing thunder. Distant thunder was heard in the afternoon, and at Adderbury, three or four miles on the south, a person who was engaged in repairing the church clock, felt a powerful electric shock when he took hold of the iron connecting rods, although no storm was then in progress there. At night, a rumour spread that there had been a "fire-ball" at Newbottle Spinney, which had knocked down a number of trees, as well as a park wall, but I did not hear of it until the Monday following. On Tuesday morning the

*Times* had the following letter from T. L. M. Cartwright, Esq., of Newbottle Manor, which led me at once to visit the spot, where I was so fortunate as to meet with that gentleman, and with Mr. Francis Dagley, of Newbottle, to both of whom I am indebted for much courteous assistance, both in the way of information, and in procuring for me interviews with those who were actual witnesses of the occurrence. This visit was repeated on the two following days in company with Mr. G. J. Symons, when many measurements were taken; and again on Saturday for photographs. Several subsequent visits have enabled me to perfect the plan, and acquire much additional information, in which I have been greatly helped by Mr. Cartwright.

#### MR. CARTWRIGHT'S LETTER.

Mr. T. L. M. Cartwright writes to us from Banbury under date Saturday:—

“May I ask you to insert the following account of a curious atmospheric phenomenon which occurred here to-day? About 12 o'clock we had a heavy storm of rain and hail, in the middle of which there was a very vivid flash of lightning, with almost instantaneous thunder of a very peculiar rattling sound. About five minutes afterwards, as I was leaving the house, my gardener called me to come quickly and see the ball of fire. I was unfortunately half a minute too late, but I have seen four persons who saw it from different points, and who all agree they heard a whizzing, roaring sound like a passing train, which attracted their attention, and then saw a huge revolving ball of fire travelling from six to ten feet off the ground. The smoke was whizzing round and rising high into the air, and a blast of wind accompanied it, carrying a cloud of branches along and destroying everything in its way. The havoc done is very considerable—large trees bodily uprooted, others broken off about ten feet from the ground, others have all their branches snapped off; in one place about 100 yards of a wall laid flat, and the remainder thrown over at intervals, as if the ball had rebounded, and some of the stones carried ten yards off. I rode this afternoon along the whole line of its journey, about two miles in length; the direction was first from S.W. to N.E., and near the end it turned N.W. Where it first began the breadth of ground travelled over was very narrow, but increased as it proceeded, till in the last field the *débris* covered a space quite 150 yards wide, and here it seems to have exhausted itself, as all the witnesses agree that the ball of fire seemed to vanish at this spot without any explosion. Here the ground had been cut in places as if by a cannon ball, but I could find no cause for this, and I saw no signs of fire on its route. One man, however, says there was a strong sulphurous smell after it had passed. About the time of this occurrence, my farm men at work about a mile in quite another direction, saw the water of a pond carried up into the air by whirlwind. The wind all day has been light from S.S.E. My pocket aneroid (made by Bryson, of Edinburgh) stood this morning at 28·45. At this moment it stands at 28·27, showing that the atmospheric disturbance has not yet begun to subside.”

Newbottle Spinney, in the county of Northampton, is rather more than four miles from Banbury, on the south-east, and is a mile and a half east of the Great Western Railway Station at King's Sutton—a village famous for its elegant church-spire of the 15th century, which is very conspicuous from the railway. A road runs from King's Sutton through the once famous Astrop Spa to Newbottle Spinney, reaching there an elevation of 180 ft. above the railway and the Cherwell valley, and of 480 ft. above sea level; thence it proceeds to Newbottle village,



half a mile further. Three quarters of a mile beyond this is a spot marked "Bunting House" on the Ordnance map, and near it is a brook which runs through Charlton, and by Walton Grounds, two farm-houses, two miles south-west, to the Cherwell. South of Walton Ground the surface rises sharply towards Aynho; north of the Spinney the ground falls again to a ford on the bridle-road to "Rosamond's Bower;" another elevation still further north, we come to the Farthinghoe Station on the Buckingham branch of the North-Western Railway, and to the villages of Thenford and Marston St. Lawrence; the latter five miles distant from Walton Grounds, at the south extremity of the line.

The storm at Newbottle occurred somewhat later than at Banbury, but its features were similar. At 12.30 p.m., there was a sharp hail-storm, lasting for a few minutes, and in the midst of it a single flash of "pale" lightning, and then almost simultaneously, rattling thunder.

#### *Barometer readings at King's Sutton.*

DEAR SIR,—I give below the readings of the barometer, corrected and reduced to sea level, for four days, which will show the atmospheric disturbance at the time of the whirlwind :—

	8 a.m.		8 p.m.
Nov. 29. ....	29.55	... ..	29.15
„ 30. ....	29.05	.....	28.80
Dec. 1. ....	29.00	.....	29.13
„ 2. ....	29.54	.....	29.64

These readings show the *greatest depression*, as well as the time of sinking and recovery.—I am, dear Sir, yours very truly,  
Mr. Beesley.

EDWIN GOOD.

Three men, Thomas Rawbone, Samuel Mitchell, and Thomas King, were with a threshing engine at the farm-buildings shown in the Ordnance map, three quarters of a mile east of "Bunting House," on the road to Hinton; they had taken shelter under a rick, and were looking towards Walton Grounds, when they noticed a strange agitation in a cloud hanging over that place. It was distinguished from the general mass of dark clouds by a look as of "smoke," or, as the engineman, Rawbone, said, of "steam." Suddenly, as Mitchell described it to me, "an arm was put forth" from this cloud, and then "something like a great cart-rope" shot down to the earth, and whirled round as fast as the fly-wheel of the engine, and rapidly mounted the hill towards Newbottle Spinney in a succession of leaps, the "rope" or pipe sometimes reaching the ground, at other times being drawn up towards the clouds. Rawbone speaks of the pipe as more like the tall trunk of a tree. As they were a mile and a half distant, they did not hear any noise, and did not notice any injury done to the trees, only the tops of which were visible from their station.

"Hoc fit ubi interdum non quit vis incita venti  
Rumpere quam cœpit nubem, sed deprimit, ut sit  
In mare de cœli tamquam demissa columna,  
Paulatim, quasi quid pugno brachique superne  
Coniectu trūdatur et extendatur in undas."

*Lucretii de rerum natura*, lib. VI. l. 431-5.

Wyatt, a milkman at Mr. Roger's farm, Walton Grounds, was during the storm at the cow-house, shown in the Ordnance map just above the "d" in "grounds" (and marked (A) in the accompanying plan). After the thunder, he left to go to the farm-house. There was but little wind then, and the hail had nearly ceased; but on reaching (B) about 200 yards west, he felt so violent a gust, apparently coming down the hill from the south, that he had to support himself by a cart which was standing there. He saw no cloud at that time, but heard a rushing noise. A "dead fence" runs north from the cow-shed to the wash-pool on the brook. As the wind passed this fence it broke a gap in it, and then first became visible as a "cloud of smoke," having probably taken up water as spray from the wash-pool and become a veritable waterspout. A pollard willow was broken down close to the east end of the cow-shed. Thomas Markham and John Seeney were working on that part of Walton Grounds near Rainsborough Camp, when they saw a cloud of smoke near the farm-house, and going up the hill, and were so alarmed that they ran off. Above this wash-pool it was first seen by the men threshing; and some men getting ironstone at a quarry on the high ground south of King's Sutton, also saw it here. Going north, the next trace of its passage is found at the north corner of a grass-field near "Ryefield-buildings" on Mr. Roger's farm, half a mile N.N.E. of the wash-pool. Here a large elm-tree was blown down, and lay with its head to north. An ash, eleven yards east of it was badly injured; but three smaller trees in the same hedgerow, respectively three, eight, and twenty-three yards west of it were untouched. A woman living in the cottage at Ryefield-buildings says, "it began in the trees behind our house. We heard a great rush of wind, but did not go out. The noise was like the clanging of doors." From the elm-tree a stream of branches stretched N.N.E. across the arable-field to the next hedge—340 yards. Here an elm was uprooted, and lay  $13^{\circ}$  W. of N., and two others, five and ten yards east, were touched. Other trees, three, eight, and twenty-three yards west of it, were untouched. Onward, for about 500 yards, the course was bare of trees, and no marks of destruction were visible; then two trees, standing in the second grass-one field south of Newbottle Spinney, were considerably damaged; on the northern corner of this field was overthrown, and one or two others in the next field, and by the side of the road leading from the Spinney to Newbottle Farm, had many branches broken. Some minor damage to fences happened near here.

Samuel Adkins, of Charlton, says that from that village he saw the whirlwind pass over some of the fields last-mentioned, and particularly noticed that the column of "smoke" revolved in a direction contrary to the sun's motion. When asked how he came to notice this, he replied that portions of the "smoke as big as a wheelbarrow," were occasionally thrown off from the main column, and after circling around it for a time, were drawn into it again.

At an angle of Newbottle Spinney, the property of Sir William

Brown, Bart, of Astrop House, just where the road from Astrop runs into the green lane leading to Charlton, a large elm was uprooted, and lay  $40^{\circ}$  W. of N. Behind, within the Spinney, two more of some size and several smaller were blown to N. The part of the Spinney over which the whirlwind next passed is planted with young ash trees, to which no damage was done; but larger trees border the road, and on the south side of it, near to the eastern entrance, two elm trees were overturned, one lying across the other, the mean direction being north.

On the north side of the road, 90 yards from the eastern entrance, a huge beech—the finest of many fine trees there—95 feet high, and 15 feet in circumference, was prostrated, the roots bringing up a ball of earth measuring 23 by 17 feet and weighing many tons. Its head lay  $14^{\circ}$  E. of N. Two large beech trees on the west lost great arms, and others behind near the gate were much injured. The thatch of a hovel was partly taken off, and straw lying in the adjoining yard was blown up into the trees.

William Adams and a boy were breaking stones on the road through the Spinney, and when the storm came on took shelter under a tree not far from the large beech. The boy, alarmed at the lightning, begged to go home. They left to do so, but had not gone far when they heard a rushing noise, and, looking back, saw a “cloud of smoke” come through the trees just where the road branches off to Rosamond’s Bower, knocking down and breaking the tress just mentioned. The “smoke” was as much as if five or six railway engines had gone by.

William Marshall, gardener at Newbottle Manor, was returning from the stables to the house. He heard a noise like a long railway train crossing a bridge, and saw leaves and branches whirled into the air above the Spinney, and immediately afterwards “a dark ball, as big as a carriage,” and sending up “a cloud of smoke,” come out of the trees with a shower of branches, and roll “over and over,” down the hill in the direction of the bridle road; the cloud of smoke at the same time whirling “round and round” with a “buzzing noise.” He distinctly saw sparks of a red colour emitted from the ball about six feet from the ground, and this is confirmed by another man, William Jilson, of Astrop, who, from a field on the west, saw fire and ran away affrighted. Notwithstanding the natural tendency in uneducated observers to assume that “where there is smoke there is fire,” I am disposed to credit these observations, although not supported by the other spectators, who, however, had not so good a view as these men had. It has been suggested that these sparks were produced by the friction of branches and twigs whirled round by the rotatory current; but I think it more likely that they were connected with electrical discharges consequent upon the friction of currents of air. Mr. Cartwright and Marshall went over the ground a few minutes after the occurrence; but they saw no trace of charred wood, nor anything to indicate combustion, and no smell of burning or of “sulphur” was perceptible. No other witness noticed the “rolling ball,” but none other saw the cloud as it came out from amongst the trees loaded with leaves and branches.

From Newbottle Spinney the whirlwind took the direction of the wall of Newbottle Park, and its course was seen by several persons working in the fields between this and Astrop on the west. A very intelligent foreman labourer, named Adams, his son and grandson, were amongst the number. They thought it looked "like hail driven up by the wind;" but the hail had ceased for some minutes, and it was hardly raining; the wind was light. They describe the branches of the trees as whirled up into the air and falling at a distance in all directions. A man running his fastest could not keep up with the cloud. William Preedy, of King's Sutton, Jessie Twinam, and three boys also saw it. Preedy thought a man running very fast might overtake it. D. Fullerton, Esq., of Aynho Park, saw it as he was walking along the elevated road from Charlton to Farthinghoe Lodge, and, like the rest, compared it to a revolving cloud of smoke.

Ten trees grew along the eastern side of Newbottle Park wall; only two of these were uninjured. The first lost a large limb; the third was touched; the fourth stripped of its smaller branches; the fifth, one foot six inches in diameter, broken short off; the seventh lost a branch; the top of the eighth was strangely twisted and broken; the ninth, a large elm, was prostrated to the W., carrying down with it a portion of the wall; the tenth was trimmed. Of the park wall, which is five and a half feet high and two feet thick, a length of ninety feet was broken down towards the bottom of the field, and some of the stones were carried thirty-eight feet to the west. A few yards above this, a small portion was thrown down to the east, the only instance of this direction. Great arms, branches, and tops of trees were scattered along the line of ruin on both sides of the wall, especially on the east or Newbottle side. At the bottom of the field, on this side, is another Spinney coming up to the wall of this and the next field. Some mischief was done here. On the farther or north side, 430 feet from the wall, two large branches were blown from an ash.

*(To be continued.)*

## THE BRITISH ASSOCIATION AT BRADFORD.

*(Continued from page 140.)*

### ON NEGRETTI'S TEST GAUGE SOLAR RADIATION THERMOMETER.

Mr. Symons stated that meteorologists had long been endeavouring to obtain an instrument whereby comparable observations of the amount of solar radiation could be made. Various experiments and observations by the Rev. F. W. Stow, the late Mr. F. Nunes, M.A., and the author, had shown that this object is attained by the use of a mercurial maximum thermometer, of which the bulb and one inch of the stem are coated with dull black, the thermometer being enclosed in a glass jacket, the bulb in the centre of a sphere of not less than two inches diameter, and from which nearly all the air had been extracted. To all thermometers thus mounted the title of vacuum thermometers had been applied. It had, however, been found that the amount of exhaustion varied considerably, and that the indications of the thermometer were thereby greatly affected. The instruments hitherto made, however, had been indiscriminately sold and used, and no ready means had been available for determining the amount of air left in. The speciality of the instrument which he exhibited was that a small vacuum gauge was inserted in the jacket, so that the precise extent to which the exhaustion had been carried could be seen at any time, and strict comparability in this respect ensured.

PROF. ZENGER, ON THE ACTION OF SYMMETRICAL CONDUCTORS AND LIGHTNING CONDUCTORS.

Professor Zenger read a paper on this subject, illustrating it with the well-known experiment in physics of placing two insulated hemispheres of brass plate in contact with another insulated sphere of brass. If the former were charged with electricity and removed from the inner brass sphere, there was found no trace of electricity on its surface. The electricity was shown to be accumulated on the surface of the outer spherical conductor, with equal tension in every point of the surface. Professor Zenger showed that if the outer hemispheres were replaced by two circular wires, no action whatever in the inner conductor was found. He said it was easy to see that this simple experiment might prove useful in regard to the construction of electric apparatus and of lightning conductors to protect buildings, and even whole cities, from the destructive action of atmospheric lightning. He had, therefore, endeavoured to ascertain the effects if any other form of a symmetrically-arranged conductor were used, instead of a circular form. In the first instance, he had tried the parabolic wires joined to the electroscope; next, a rectangular wire with five different openings. If placed exactly in the middle of the rectangular wire, no action was observed; if placed eccentrically, however, there was small but increasing action; and if he placed a needle or another sharp-pointed instrument between the protecting wire and the electroscope, he still better observed the different action produced by placing the electroscope in an eccentric position. He therefore thought that it was possible by symmetrical wires placed on buildings or over whole cities, so to procure an entire protection from atmospherical electricity. If the electric clouds should even enter between the objects protected and the protecting wires, their activity would be greatly diminished, for the wires would become immediately charged, and nearly all the electricity accumulated on their surface without any danger to the protected buildings.

Mr. Glaisher, who had taken the chair in the temporary absence of the president, said their thanks were due to Professor Zenger for his communication upon a subject so important. What they wanted to know was the distance at which buildings were protected by a lightning conductor, and Professor Zenger's assertion that the sections of a globe were as effective as the whole globe itself, would be an important addition to scientific knowledge if proved to be so.

Professor Clerk-Maxwell, who said he had paid some attention to the subject of shielding bodies from electrical action by means of the wire, feared the form that Professor Zenger had given them would be rather difficult to work out mathematically.

Professor Zenger said that the correspondent of the *Engineer* newspaper had just informed him that the instrument hut of the Atlantic Telegraph Company at Valencia, was protected by wires on the principle he had just mentioned, and the plan of protecting the hut had been devised by Mr. Cromwell Varley.

F. H. WENHAM, ON THE INFLUENCE OF TEMPERATURE ON THE ELASTIC FORCE OF SPRINGS.

Mr. F. H. Wenham said that at the last meeting of the British Association, at Brighton, Professor Phillips brought forward some remarkable facts relating to the aneroid barometer, showing that in new instruments a permanent set or difference of indication was caused by high temperature, and that a number of alternations of heat, extending over some period of time, were required before the elastic plate became so completely seasoned (so to term it) as to ensure regularity in the indications. It has long been known to meteorologists that thermometers, though accurately graduated at first, acquired after a few months an index error of sometimes 2 or 3°, arising from a tendency of unannealed glass forming the material of new bulbs, partly by under tension, to return to a state of equilibrium with a consequent alteration in capacity, thus showing the propriety of seasoning the instruments by repeatedly subjecting them to the extremes of temperature they were capable of bearing before finally setting them to scale. Mr. Wenham gave the results of a series of experiments he had made in connection with instruments for measuring and regulating time, force, and temperature. He said that a comparison of numerous data might develop a definite law very useful to the practi-

tioner in the various instruments to which it related. The most singular result was that indicating that a metal whose elasticity was obtained by condensation of the material, should lose it equally with equal degrees of heat, while steel, in which elasticity resulted from fire in the process of hardening and tempering, obeyed a different rule. Possibly this might give some reason for the fact that a gold alloy had been used by some chronometer makers in lieu of steel balance-springs, probably rendering a secondary compensation less necessary. He had seen such springs in use, but had never heard it stated why they had been applied. It was a long established fact that if a chronometer was adjusted for extreme temperatures, it would be incorrect for mean ones or the converse. To meet the irregular way in which the elasticity of steel was affected by heat, this law of elasticity in relation to temperature once ascertained, might determine the path in which the compensating weight should traverse, so that a due proportionate decrease of central force might counteract the elastic loss of the spring by increase of temperature. The indications with glass were far less definite, but to demonstrate how great and sudden changes of temperature might affect a thermometer, the following experiment had been tried:—The bulb of a thermometer was suddenly plunged into melted lead. The mercury instantly darted down far below zero. The action was so quick that the point could not be ascertained. This was caused by the sudden expansion of the bulb by heat before it reached the mercury, by conduction this then began to rise very rapidly, and before it had arrived at the top of the tube the bulb was withdrawn. This requires adroitness, for as we all know, the instant that the mercury touches the top, the bulb will burst. This must be greased before immersion in the fused lead, otherwise a film of the metal will adhere and retain sufficient heat to carry the mercury to the top, with a consequent fracture. A thermometer treated in this rough manner afterwards showed an index error of six degrees, the mercury having risen to this extent; but after a few days the equilibrium was partly restored, and the error remained permanently at three degrees. As a comment on the above experiments it might be urged that a source of inaccuracy would arise from a vertical force acting on a lever, varying in length, but after the deflecting weights were suspended the arm was brought so far above the horizontal line as to divide the remaining small arc due to the heat deflection. The sine of the chord for this in a radius of 12 inches was too minute to make any difference in the force of leverage worth noting. Further experiments were required, but the present ones showed directly in all instruments for indicating and registering weight, pressure, temperature, and perhaps time, by means of the law of elasticity, that the material, whether of steel, glass, and particularly any metal in which this property was obtained by condensation or hammering, the importance of subjecting them to an excess of temperature before the graduations and adjustments were made.

#### G. M. WHIPPLE, ON A NEW FORM OF RUTHERFORD'S MINIMUM THERMOMETER.

Mr. G. M. Whipple, B.Sc., said that the common instrument has a bulb either spherical or cylindrical, and it is found that, owing to the slow rate at which the expansion of alcohol takes place, rapid changes of temperature of the air frequently pass unrecorded by it. The new instrument devised and constructed by Mr. Hicks, has its "bulb" formed as a double cylinder, open at either end, the spirit being a thin film between the two glass coats. By this means the surface exposed to the air is immensely increased, and consequently the thermometer is enabled to follow sudden changes with a rapidity almost equalling that of mercurial instruments. Experiments made at the Kew Observatory were briefly described, which showed that the instrument acts up to the expectations of its constructor.

Mr. Symons thought that the instrument would be well adapted for terrestrial radiation purposes.

Professor Carey Foster suggested that the variations in the sensibility of thermometers might be slightly attributable to the use of diluted alcohol.

Mr. Glaisher said attention should be directed rather to getting a mercurial minimum thermometer than to improving the alcohol one.

**PROF. HERSCHEL, ON THE CONDUCTIVITY OF ROCKS.**

Professor Herschel stated the results of some experiments on the conductivity of rocks. The means by which he had endeavoured to get some certain results on this point were the enclosure of a box of heated water in non-conducting material, and in contact with the rock whose conductivity was to be tested. A delicate thermo-electric pile then measures the amount of heat conducted by the stone. Professor Herschel said that results of very great value had not yet been attained with certainty. Amongst other things, however, it had been ascertained that shale had a very low conducting power.

**C. MELDRUM, ON A PERIODICITY OF CYCLONES AND RAINFALL IN CONNECTION WITH THE SUNSPOT PERIODICITY.**

Professor Balfour Stewart, in the absence of Mr. C. Meldrum, read a paper by that gentleman on a periodicity of cyclones and rainfall in connection with the sunspot periodicity. The author attempted to establish that there is periodicity in those districts visited by cyclones. An important catalogue of cyclones, including the dates, localities, maximum force of wind, and other information of a valuable character, supplemented the paper, which appeared to show that there was a maximum of rainfall connected with each maximum of cyclones in the Indian Ocean, and gave evidence that the periodicity of cyclones was connected with the periodicity of sunspots.

**ARTHUR SCHUSTER, ON A CURIOUS PHENOMENON OBSERVED ON THE TOP OF SNOWDON.**

Mr. Arthur Schuster gave a short description of a curious phenomenon observed on the top of Snowdon. He stated that about two years ago as he and his brother were coming down from the top of Snowdon about half an hour after sunrise, their attention was directed to a light spot which seemed to walk with them. On the spot was a coloured bow. Then a second bow appeared, and then another and another till five consecutive bows were seen at once. In one of the bows he saw his own shadow. The fog approached the spot where he stood, and as it approached the outer bows disappeared while the inner bow took brilliant colours and contracted so as to form an entire circle round his shadow. At last, when the fog was about two feet away, he could see the shadow of his own head surrounded by a brilliantly coloured circle. Two seconds afterwards he was surrounded by a dense fog. One single fog bow had often been observed, but he did not know whether more than one had ever been seen.

Professor Forbes said that such phenomenon had frequently been witnessed, but he had never heard of so many as five bows being seen at once; and he confessed that he had sought in vain for an explanation such as that which Mr. Schuster was in search of. Had that gentleman been able to give the size of the bows, and the distance between them when the cloud was a certain distance from him—say fifteen or twenty yards—they might have had some data on which to work.

Mr. T. J. Pearsall said it would also be of importance to determine the amount of darkness between the lines of the bows.

Mr. Glaisher had heard of, and seen, similar phenomena, but not more than three rings.

**G. M. WHIPPLE, ON THE PASSAGE OF SQUALLS ACROSS THE BRITISH ISLES.**

Mr. G. M. Whipple, Kew Observatory, read a paper on "The Passage of Squalls across the British Isles." After exhibiting the uncertainty attendant upon the investigation of meteorological laws by the aid of observations made over a small part of the earth's surface like the British Isles, owing to the want of well-marked characteristics serving to identify and track out masses of air moving over the country, Mr. Whipple called attention to squalls occurring abruptly, and presenting certain definite features recorded in a conspicuous manner by self-recording meteorological instruments, when they passed over them. The appearance of the instrumental curves at the time of a squall was described and illustrated by means of tracings from the quarterly weather reports

of the Meteorological Committee, and a table was exhibited showing a brief history of twenty-three squalls registered in the reports from 1869 to 1873. From this it appeared that their motion was almost invariably in a direction from west to east, with a velocity diminishing as they progressed. The velocity of the easterly motion was sometimes as high as 100 miles per hour, and fell as low as ten miles; the rate given by the whole series being thirty-eight miles per hour. Referring to other papers which had appeared on these phenomena, Mr. Whipple suggested that use might with advantage be made of a better knowledge of squalls in issuing storm warnings.

#### J. PARK HARRISON, ON LUNAR INFLUENCE ON CLOUDS AND RAIN.

Mr. J. Park Harrison said he first brought before the British Association as a tyro fifteen years ago the fact that the temperature of the air seemed to be affected by the time of the moon's age. He followed Sir John Herschel in believing that the moon had a certain influence in either raising clouds to higher elevations or dispelling them. This was consistent with his idea that a certain amount of cloud increased the temperature. It appeared to him clear that it was to the influence of the moon that the alteration in cloud quantities was to be attributed. He said that a tabulation of the amounts of cloud according to the age of the moon, by Professor Schiaperelli, in Italy, showed that the moon affected cloud; and these results were confirmed by tables of rain arranged in the same way by Mr. Chase in America, and by Mr. Hennessey in India.

The Chairman said it was an important question whether the clouds of day as well as of night were included, as there was a great difference between the two. To determine the problem they wanted the amount of cloud when the moon was above the horizon, and not otherwise, at which time clouds were more continuous, covering more sky than during the day.

Mr. G. M. Whipple suggested that telegraphic communication might be established between Greenwich and Kew, and simultaneous observations taken, so as to determine the absolute altitude of well defined clouds.

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#### BALLOONS AND UPPER CURRENTS.

*To the Editor of the Meteorological Magazine.*

SIR,—The great American balloon project, though it has collapsed, may not have been altogether in vain.

I am rejoiced that the balloon came to grief—1st, because I apprehended danger to the aeronauts—it appeared to me a fearful risk of human life; and 2ndly, because it is derogatory to the dignity of science to mix up its advancement with newspaper advertising.

This remark applies with equal force to scientific serials, which ought to be devoted to purely scientific purposes; for, unless the advertising sheet be kept very select, the periodicals are in danger of degenerating into mere trade circulars.

But though the balloon voyage from America to Europe be neither desirable nor probable, the scheme suggests anew the advisability of employing balloons for the purpose of determining the direction of the upper aerial currents. It might be very useful to ascertain whether there really is an upper westerly current over the Atlantic, and equally so to know the direction of the superposed currents in the regions of the Trades, Cyclones, and elsewhere.

Yet all this might be accomplished without jeopardising human life. On the present occasion, I can only suggest a scheme for accomplishing this—not to state it in its entirety—and ask for the opinion of others.



I propose, then, that trial balloons be used; they may be of two classes. (a). Floating, or as they would be used as bottles upon the ocean, they might be called "Bottle Balloons." It would be for those practised in aeronautics to decide the particular size and formation of these balloons, but I think they need not be very large. The details of their construction must be carefully considered. I would have them weighted, so as to prevent their rising above the desired height, or fitted with valves, which should be self-acting, that is, to be opened by the distention of the balloon in rarefied air. This would ensure their descent at a time which might be calculated. The starting-point, the time occupied in the voyage, and the place of descent, would enable us to calculate the most probable direction of their course. They must be made to float in water, in case of their falling into the ocean.

(b). Captive balloons could be used at some of the great meteorological stations, and constant observations made with them, as with the vane for the lower currents. It would be possible to go still further with this plan, and actually carry out the American idea (avoiding the fearful risk), and making the balloon captive to a steam vessel, the vessel following the lead of the balloon or balloons, which would not be beyond telescopic range.

SAML. H. MILLER.

*Wisbech, November, 1873.*

### THE FROST IN OCTOBER 1873.

Low temperatures are to be expected occasionally in October, but it is not every year that it has so cold a period as the past has been. We have selected for the table those days on which the lowest temperatures most generally occurred, but, as is shown by the following note from Mr. Stow, in some localities the lowest temperature fell on other days.—Ed.

*To the Editor of the Meteorological Magazine.*

SIR,—Perhaps the following notes of temperature, &c., in Wensleydale, may be of interest for the purpose of comparison. September 27th, max.  $71^{\circ}8$ , min.  $43^{\circ}1$  (at Arncliffe I see it is reported to have been  $26^{\circ}$ ); September 29th, min.  $28^{\circ}6$ ; 30th,  $27^{\circ}9$ . October 3rd, max.  $66^{\circ}$ , min.  $54^{\circ}$ ; 9th, min.  $25^{\circ}6$ , 8 a.m.,  $30^{\circ}8$ , 9 a.m.,  $37^{\circ}5$ , 9 p.m.,  $52^{\circ}$ ; min. on 13th,  $29^{\circ}6$ ; 15th,  $27^{\circ}$ ; 16th,  $28^{\circ}8$ ; 19th,  $31^{\circ}6$ ; 24th,  $27^{\circ}$  (?); 25th,  $24^{\circ}8$ ; 26th,  $28^{\circ}$ ; 27th,  $24^{\circ}$ ; 28th,  $29^{\circ}3$ ; 29th,  $29^{\circ}5$ ; 30th,  $34^{\circ}2$ . It was below  $32^{\circ}$  in air on 11 days in October, and on grass on 14 days, the lowest being  $20^{\circ}$ . The 24th was the coldest day, mean about  $31^{\circ}$ , and on the 27th the mean was  $33^{\circ}$ . On the 27th it was as low as  $29^{\circ}7$  at 9 a.m. The atmosphere became hazy on the 28th, and the frost less severe.

Rainfall—total in October  $3.26$  in., of which  $.83$  in. fell on 1st, and  $.43$  in. on 31st. On the 1st heavy rain began at noon, and at 5.30 the flood came down the Yore like a low wave. I observed the water rise about  $2\frac{1}{2}$  feet in the first two minutes; the phenomenon, I am told,

is not uncommon. Its rate of progression at the point I saw it was about five miles an hour. Snow fell heavily on the hills on the 23rd, and heavy gales occurred on 10th and night of 31st.

I am Sir, your obedient servant,  
Aysgarth, Bedale, November 1st, 1873.

F. W. STOW.

*Minimum temperature in shade, in October, 1873.*

Div.	STATIONS.	28th.	29th.	30th.	31st.
I.	Camden Square .....	27·4	27·1	26·2	27·4
„	Pinner Hill .....	—	—	29·0	—
„	Winchmore Hill .....	—	23·0	—	—
„	Harrow .....	18·0	—	—	—
II.	Addiscombe .....	26·5	24·5	25·5	28·5
„	Greenwich .....	27·7	26·7	27·0	28·9
„	Bromley Common .....	—	23·0	—	—
„	Strathfield Turgiss .....	24·8	23·2	23·3	26·4
III.	Addington Manor .....	—	21·0	21·0	—
„	Magdalen College, Oxford...	20·0	—	—	—
IV.	Wereham .....	—	19·2	—	—
V.	Dartmoor Prison .....	30·0	33·5	32·0	37·0
„	Druid House, Ashburton ...	32·0	—	32·0	—
„	The Castle, Taunton .....	—	25·0	25·0	—
VI.	Sansaw Hall, Wem .....	—	—	27·0	—
„	Brereton, Leamington .....	—	25·0	—	—
VII.	Leicester .....	26·2	23·0	27·2	—
„	Coston, Melton Mowbray ...	—	22·0	—	—
„	Calcethorpe Manor, Brigg...	—	27·9	—	—
IX.	Stanley Vicarage, Wakefield	21·0	—	—	—
„	Moorside, Halifax .....	—	29·5	—	—
XI.	Castle Malgwyn, Llechryd...	19·0	19·0	—	—
XXI.	Twyford, Athlone .....	24·0	—	—	—

For low shade temperatures at other stations see table, page 161.

*Min. temp. on grass during same period.*

I.	Camden Square .....	21·4	21·6	20·9	22·4
II.	Addiscombe .....	20·5	19·0	18·8	25·0
„	Greenwich .....	22·1	20·0	22·0	22·9
„	Strathfield Turgiss .....	19·7	17·4	21·3	25·4
V.	Dartmoor .....	28·0	30·5	29·7	32·5
„	Bodmin .....	—	—	26·0	—
XI.	Haverfordwest .....	22·0	—	—	—

ERRATUM.

*To the Editor of the Meteorological Magazine.*

SIR,—Will you kindly in your next number correct one mistake in my letter of the 16th September, as published in your magazine for the present month? The word “north” in the tenth line should be “south-west.”

The error is so evident from the context, that a correction is almost superfluous; still it is better to be accurate.

I am, Sir, yours &c.,

ALFRED NORTH.

28, Lansdowne Crescent, Notting Hill, W., Oct. 22nd, 1873.

# OCTOBER, 1873.

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 $\geq 1$ or more fell.	Max.		Min.				
				Dpth.	Date.		Deg.	Date.	Deg.	Date.			
											inches.	in.	
I.	Camden Town .....	2.97	+ .38	1.04	12	15	73.4	2	26.2	30	5	13	
II.	Maidstone (Linton Park) .....	3.31	+ .21	.68	23	18	78.0	2	27.0	31	...	...	
	Selborne (The Wakes) .....	3.72	— .49	1.05	12	15	68.0	3	21.5	29*	10	11	
III.	Hitchen .....	2.48	— .07	.72	12	15	65.0	2, 3	23.0	29	9	..	
	Banbury .....	1.84	— .59	.41	22	15	70.4	3	22.0	29	...	7	
IV.	Bury St. Edmunds (Culford) .....	3.57	+ .86	.89	12	13	69.0	1, 3	22.0	29	10	14	
V.	Bridport .....	2.49	+ 1.54	.34	7	15	70.0	2, 3	24.0	29*	7	...	
"	Barnstaple .....	4.46	+ .34	.89	22	19	72.0	2	30.5	29*	...	...	
"	Bodmin .....	4.51	— .81	.68	7	24	78.0	19	33.0	28	0	5	
VI.	Cirencester .....	2.36	— 1.13	.41	21	17	...	...	...	...	...	...	
"	Shiffnal (Houghton Hall) .....	2.38	+ .14	.46	21	20	67.0	1	23.0	28†	7	...	
"	Tenbury (Orleton) .....	2.05	— 1.18	.50	21	17	69.8	1	22.8	28†	9	14	
VII.	Leicester (Wigston) .....	2.01	— .69	.43	22	15	72.0	3	25.0	28	9	...	
"	Boston .....	1.37	— .75	.23	12	16	71.0	3	25.0	30	7	...	
"	Grimsby (Killingholme) .....	2.31	...	.53	11	16	66.5	2, 3	31.0	28†	2	...	
"	Derby .....	2.40	— .44	.72	11	13	67.0	1, 2, 3	26.0	29	7	...	
VIII.	Manchester .....	4.44	+ .63	.79	21	20	68.0	3	26.0	27†	8	9	
IX.	York .....	1.67	— .85	.41	2	16	62.5	10	28.0	25	11	...	
"	Skipton (Arncliffe) .....	9.10	+ 2.44	1.64	9	22	63.0	3	21.0	9	...	...	
X.	North Shields .....	2.24	— 1.04	1.08	2	16	62.2	1	30.0	27	3	8	
"	Borrowdale (Seathwaite) .....	21.23	+ 4.91	4.20	9	21	...	...	...	...	...	...	
XI.	Cardiff (Ely) .....	5.32	— .43	1.17	22	19	...	...	...	...	...	...	
"	Haverfordwest .....	4.43	— .76	.65	6	23	67.0	3	24.9	27	5	10	
"	Rhayader (Cefnfaes) .....	3.34	— 2.26	.50	9, 31	20	65.0	...	24.0	...	...	...	
"	Llandudno .....	3.98	+ .02	.56	21	21	67.4	1	33.0	26	0	...	
XII.	Dumfries .....	4.83	— .09	1.20	2	23	60.5	10	23.5	27	11	13	
"	Hawick (Silverbut Hall) .....	3.91	...	1.10	2	18	...	...	...	...	...	...	
XIV.	Kilmarnock (Annanhill) .....	6.08	...	.90	1	24	56.6	5	27.2	27	3	8	
XV.	Castle Toward .....	8.19	+ 2.44	1.40	7	22	59.0	3	26.0	27	5	...	
XVI.	Leven (Nookton) .....	3.73	— .02	.84	2	16	60.0	4, 18	25.0	27	6	18	
"	Stirling (Deanston) .....	6.26	+ 1.35	.76	11	28	56.3	1	21.0	27	10	23	
"	Logierait .....	4.20	...	.59	2	19	57.0	17	25.0	24	8	...	
XVII.	Braemar .....	3.89	+ 1.14	.67	31	20	59.2	13	23.0	27	7	24	
"	Aberdeen .....	2.56	...	.71	31	20	58.5	12	29.5	9	5	16	
XVIII.	Inverness (Culloden) .....	2.30	— .36	.23	2	21	54.1	9	34.7	27	0	14	
"	Portree .....	11.67	+ .89	1.39	19	29	...	...	...	...	...	...	
"	Loch Broom .....	9.80	...	1.08	31	29	...	...	...	...	...	...	
XIX.	Helmsdale .....	5.65	...	1.82	31	24	...	...	...	...	...	...	
"	Sandwick .....	6.56	+ 1.64	.82	10	28	53.6	18	35.7	21	0	8	
XX.	Cahereiveen Darrynane Abbey .....	6.95	...	1.40	8	25	...	...	...	...	...	...	
"	Cork .....	2.17	...	.33	6, 29	10	...	...	...	...	...	...	
"	Waterford .....	4.19	— .21	.81	30	23	64.0	3	31.0	28	3	...	
"	Killaloe .....	6.57	+ 1.55	1.02	1	22	70.0	1	26.0	28	4	11	
XXI.	Portarlington .....	3.58	— 1.55	.86	1	29	66.0	1	27.0	25	4	...	
"	Monkstown .....	2.76	— 1.16	1.26	24	18	68.0	3	24.0	15†	11	...	
XXII.	Galway .....	5.50	...	.87	2	23	65.0	3	28.0	27	4	...	
XXIII.	Bunninadden (Doo Castle) .....	4.81	...	...	...	...	...	...	...	...	...	...	
"	Waringstown .....	2.49	...	.38	21	17	67.0	3	26.0	24	6	14	
"	Edenfell (Omagh) .....	4.00	...	.68	2	24	65.0	1	23.0	25	7	...	

\* And 30.

† And 29.

‡ And 28.

+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.—Great atmospheric disturbance on 23rd, when there was T and L, and the bar. fell to 28·48 in. ; it, however, quickly rose again, and on 28th was 30·21 in., a rise of 1·73 in. in five days. Several fine bright sunny days, with a full average of frosty mornings, but only severe on 31st. Winds various, and about the average of fogs.

SELBORNE.—Prevailing winds first three weeks S.W., last week N.E. Sudden change from N.E. to S.W. on 31st; the last week's temp. very low, the average min. being only 27°·3—the coldest week I have ever recorded in October. Fog on 1st, 2nd, 19th (all day), 24th, 25th and 31st; 1st and 25th very dense. frequent white frosts.

HITCHEN.—The lowest temp. (23°·0) ever registered in October.

BANBURY.—High winds on 8th, 10th, 21st and 22nd. Fog on 24th, 28th, 29th and 30th.

CULFORD.—The last week exceedingly cold, the min. on 29th being 22°·0, or one degree lower than was experienced during the year 1872. Mean temp. of the month 46·4 in. Polar winds on four days; equatorial winds on 27 days. T with heavy R on the 8th.

BRIDPORT.—On the 22nd it was blowing a heavy gale till 6 p.m., when it ceased, and fine starlight continued till 12 p.m., then it blew harder and harder, till 4.45 a.m. it blew with hurricane force, quite shaking the house.

SHIFFNAL.—Up to the 13th the weather was mild, the max. averaging 58·7 in., with R almost daily, and on the 21st it rained the whole day, with great fall of bar., followed on 23rd by R mixed with S, and on 24th by TS with heavy R at 5 p.m. from N.; the prevailing winds were from W. and S.W. From 22nd inclusive, frosts nightly to the 31st. Dense fog on 19th and 24th. Vast quantities of acorns and of hips; one red admiral butterfly seen on the 12th, and fieldfares on the 27th.

ORLETON.—Although the first 11 days were generally warm and pleasant, the mean temp. of the month was about 4° lower than the average. Severe frosts occurred frequently, and on the mornings of the 28th and 29th the ther. (protected) fell to 22°·8 each morning, which is lower than any reading in October since 1859. In the latter part of the month the fluctuations in the bar. were very great. On the 23rd the mercury fell to 28·70 in. and on the 28th it stood at 30·30 in. On the 22nd there was a great wind; L was seen frequently on the nights of the 23rd and 24th, and distant T was heard on the 23rd, 24th, and 25th. On the 24th it was tolerably loud and frequent in S.E. On the 23rd a storm of H covered the ground, but there has not been any S.

WIGSTON.—Exceptionally cold during the last ten days of the month. The month proved favourable for agricultural operations, and good progress was made in wheat sowing and lifting potatoes.

BOSTON.—Temp. on 3rd 71°, the highest of the seven years on record, the next highest was in 1869, when 68° was registered. Sharp frosts on 8th, 9th and 25th, on the 30th the temp. fell to 25°, the water in the canal having a thin coat of ice. On 6th and 8th very high tides although the wind along the N. coast was light, varying from W. to N.W. and S.W. The rise of the water above low water in the estuary was 24 ft. 10 in.; an average spring-tide rising 22 ft. It is most unusual for the tide to rise to such a height except under the influence of a strong N.W. wind.

GRIMSBY.—TS with heavy rain following on the 3rd; stormy night on 10th; H and R on 26th; fieldfares arrived on 28th; latter part of the month cold but fine; altogether a pleasant month; a fine seed time; many rime frosts; great fluctuation of the bar, but no storms here.

MANCHESTER.—H on 7th, 13th, 14th, and 20th.

ARNCLIFFE.—S on 22nd.

NORTH SHIELDS.—TS on 12th, L on 22nd.

SEATHWAITE.—T on 8th, 20th, and 25th; L on 17th and 20th. Ten days on

which 1 in. or more of rain was registered, five on which 2 in. or more fell, and one (the 9th), when the fall was 4·20 in., the total fall for the month being 21·23 in.

# W A L E S .

**HAVERFORDWEST.**—A very wet stormy month, taken altogether a cold one ; very sharp frosts set in on the 24th, and continued till the 29th, during which time the sky was clear and the air calm ; the bar. attained a great elevation ; the end wet and stormy ; L and H on 8th ; heavy gales on 21st from N.N.W., and on 23rd from S.S.W. ; bar on 23rd 28·88, on 26th 30·10, and on 27th 30·51.

**CEFNFAES.**—This month has been cold, and severe frost for so early in the season. S on the hills ; prevailing winds N.E. and N.W.

**LLANDUDNO.**—Sea fog passed over at 5 p.m. on 4th ; stormy, with a warm wind, on 10th, T during the night ; H showers on 13th and morning of 14th ; constant H showers on the 20th ; stormy with H showers in the afternoon of 23rd, L in the evening, and S on the hills on the 24th.

# S C O T L A N D .

**DUMFRIES.**—Up to the 23rd, excessively wet ; heavy R on 2nd ; occasional frost at night ; frequent storms with S on 14th and 23rd, after which severe frosts at night with fine days. The close of the month wet and stormy. The mean temp. 2°·7 below that of corresponding month. The frost greatly injured the potatoes, a considerable breadth of which are still to be dug.

**SILVERBUT HALL.**—Very stormy on 1st, 2nd and 10th, but the month on the whole has been a mild one.

**KILMARNOCK.**—Havy gales on the 6th, 20th and 21st ; ozone was scarce ; considerable frost on 8th, 9th and 13th, and from 23rd to 27th ; H and S fell on 20th and 23rd. On 23rd Arran and surrounding hills covered with S ; L on 12th ; much grain was standing and in stook at the middle of the month, and it was not till its close that the fields could be said to be cleared. Death rate 38 per 1000, principally consumption and fever.

**BRAEMAR.**—A very favourable month for harvest operations. Auroræ on 15th and 22nd. Lunar rainbow on 5th ; L on 7th.

**ABERDEEN.**—Bar., temp., and R all rather below the average, wind pressure slightly above it ; TS on 7th, with H ; L on seven other days ; auroræ on seven days ; a cold and rather dry month, with high winds. On the 20th the fields in the interior were in many cases covered with one or two inches of S.

**CULLODEN.**—Large lunar halo on 4th, 6th, and 9th, solar halo on morning of 16th, faint aurora on 17th ; T on 5th at 4.50 p.m. ; L on 6th and 14th ; bar. down to 28·52 at 2 p.m. on 22nd.

**PORTREE.**—Very wet and stormy ; strong gale from S. on 6th. R, sleet or S showers nearly every day, with frost at night ; high ground covered with S the whole month, and October has failed this year to be the highlanders' harvest month, for about one half of the corn is still in stook, in very bad condition, and very few of the potatoes are lifted ; the ground is quite soaked with wet ; upwards of 1 in. of R fell on four days in this month.

**LOCHBROOM.**—With nearly 10 inches of R, and only two dry days, this month may almost be considered as a continued downpour. Some of the grain and many of the potatoes are still in the fields, and the S nearly down to the bottoms of the valleys. With the exception of December, 1866, and November, 1869, this has been the greatest fall of R recorded here since I began in 1865. On Monday, the 20th, there was a terrific storm from the N.W., and on Monday, the 6th, we had one of the highest tides for many years. Falling stars have been very frequent during the month.

**SANDWICK.**—October has been wetter and colder than the mean. There were gales on four days, and that on the 20th were the strongest we have had for years, being 70 miles an hour. Auroræ on four nights. October is generally our wettest month, but this year the R and wind have been excessive, and injured the grain crops and the potatoes. Flocks of swans arrived on 9th and 15th, very early.

# I R E L A N D .

**DARRYNANE.**—The rainfall this month is less than in any October since I began to take observations in 1870. Prevalent wind N.W. ; H showers on 7th,

13th, 22nd, and 23rd ; hoar frost on 5th, 26th, and 27th. The comparative dryness of the month has saved the farmers from a threatened hay famine, a serious matter in this country, which depends entirely upon butter and stock. T on 22nd.

MONKSTOWN.—There was an unusual number of frosty nights (11) without being followed by R, as is usually the case at this time of the year ; the min. too is very low,  $24^{\circ}0$  ; T S with 1.26 in. of R on the 24th.

DOO CASTLE.—Wet month. Potatoe digging progressing slowly in consequence. A few nights of severe frost towards the close of the month.

OMAGH.—Weather till the 20th unusually mild and wet for the season ; fourth week fine with occasional very hard frosts.

### REVIEW.

*Negretti and Zambra's Encyclopædic Illustrated and Descriptive Catalogue.* 500 pages, large 8vo. Negretti: Holborn Viaduct.

A CATALOGUE, with 3,180 separate items, ranging from watch glasses (1865) to smith's forges (2,014), from 6-horse power steam engines (2,740) to chloroform (3,074), from spectacles at two shillings per pair (1044) to equatorials \* at £342 and upwards (1234), may well be described as "Encyclopædic," and is a tolerably distracting subject for a reviewer.

For instance, there are between one and two hundred varieties of thermometers, at prices varying from 1s. to £5 5s., and yet singularly enough, omitting one variety (we pronounce no opinion on its merits), viz., that of the pencil case withdrawing clinical thermometer.

The special features of the catalogue, in addition to its comprehensiveness, are,—(1), the details of several instruments not in any other catalogue ; (2), a series of generally well written and correct notes on a variety of subjects. We may enumerate a few of the former : Long Range Barometers by McNeild and Howson, Saussure's and Jones's Hygrometer, Leslie's Thermometric Hygrometer, Prestel's Anemometer ; and, to leave Meteorology for a moment, the Sciopticon, which strikes us as a capital modification of the magic lantern. It is, we believe, an American idea, and seems well worth examination by those who wish to avoid the trouble and danger inseparable from the use of the oxyhydrogen light. Of course, in so large a catalogue there are sure to be some errors, but there are very few. A curious one occurs on page 31, in describing Negretti and Zambra's second patent mercurial minimum thermometer, it is stated that "This thermometer, like Negretti and Zambra's patent maximum, has a small plug of platinum wire inserted in the supplementary tube." Considering that their patent maximum has neither "supplementary tube" nor "platinum plug," the appropriateness of the description is not obvious ; and, moreover, its price is omitted. With such a multitude of items a good index is indispensable, and we are glad to say that the index, which occupies 34 pages, is worthy of the handsome and instructive volume which it appropriately closes.

\* We should be glad to see the orthography of this word settled. Negretti's give equatorial, and it is so given in Arago's *Astronomy* (Smyth and Grant's translation), in Chambers's *Hand Book of Astronomy*, the *Astronomical Register*, and Drew's *Manual of Astronomy*. On the other hand, the Astronomer Royal, in all the Greenwich publications, spells it Equatoreal, so does Hind in his capital *Astronomical Vocabulary*.



Injured Trees be marked thus:

Stanford's Geog<sup>y</sup> Estab<sup>y</sup> London



# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XCV.]

DECEMBER, 1873.

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

## LONG CONTINUED HIGH BAROMETRIC PRESSURE.

Writing, as we do, on the 12th consecutive day of a pressure exceeding 30·40 at sea level, and with it still steady at 30·60, it is not for us to say how much longer it will continue; but as it is already a period of unparalleled duration during the past 14 years, we believe it will interest many of our readers to compare it with previous periods in which the pressure has exceeded 30·50 at sea level. In the following table we therefore give *all* the instances of pressure exceeding 30·50 (and occasionally a few lower ones) from 1860 to the present time, as extracted from the Camden Town Observations. The extreme height reached this year has not yet been remarkable; but the persistency of high pressure is without parallel since 1860, if not for a still longer period. The absolute extremes are denoted by \*, and where they were observed at other than the regular hours, they are given at the end of each year.

	1860	9 a.m.	9 p.m.
February 13.....	30·595	...	30·614
14.....	·624*	...	·600
15... ..	·554	...	·350
March 6.....	·575*	...	·283
November 7.....	30·532*	...	30·492

	1861		
January 21.....	30·507*	...	30·489
February 2.....	·676	...	·689
3.....	·528	...	·314
April 9.....	·565	...	·592*
10.....	·577	...	·504
11.....	·503	...	·469
Novembr 18.....	·353	...	·582
19.....	·604*	...	·441
Decembr 27.....	·595*	...	·567
28.....	·559	...	·540
29.....	30·514*	...	30·492

February 2, 30·729 at 0.30 p.m.  
December, from 19th, to January 2nd,  
never below 30·262

	1862		
February 8.....	30·605	...	30·689
9.....	·630	...	·631
10.....	30·566	...	30·465
February 8,	30·690	at 8 30 p.m.	

	1863	9 a.m.	9 p.m.
January 27.....	30·199	...	30·510
28.....	·569	...	·260
February 12.....	·347	...	·524
13.....	·681	...	·693*
14.....	·677	...	·592
15.....	·633	...	·629
16.....	·663	...	·681
17.....	·655	...	·589
18.....	·537	...	·464
March 24.....	·509	...	·526
25.....	·558*	...	·431
November 6.....	·512	...	·447
Decembr 18.....	·492	...	·605*
19.....	30·502	...	30·478

January 28, \*30·587 at 10 a.m.

February, from 12th to 26th, only  
once below 30·340, and never below  
30·000 from the night of the 2nd to  
the end of the month.

	1864		
January 2... ..	30·516	...	30·608
3.....	·657*	...	·656
4.....	·609	...	·485
29... ..	·402	...	·513
30.....	·532*	...	·438
November 6.....	·606	...	·690
7.....	·543	...	·304
December 24.....	·538	...	·595*

1865			
February	10.....	30·595 ...	30·544
	11.....	·597* ...	·514
June	7.....	·397 ...	·582*
	8....	·536 ...	·484
Novembr	12.....	·442 ...	·504*
December	8.....	·580 ...	·586
	9.....	·556 ...	·572
	10.....	·627 ...	·658
	11.....	·721 ...	·720
	12.....	·688 ...	·594
	13.....	·545 ...	·523
	14.....	·516 ...	·477
	15.....	·713 ..	·782*
	16.....	·711 ...	·687
	17.....	·687 ...	·619
	18.....	30·544 ...	30·444
June, never below	30·220 from 4th to		
23rd. Mean of the month,	30·221.		

1866			
January	23.....	30·128 ...	30·572
	24.....	·578 ...	·649
	25.....	·663* ...	·642
	26.....	·640 ...	·496
October	7.....	·505* ...	·459
December	8.....	·264 ...	·512*
	20.....	30·530* ..	30·457

1867			
February	3.....	30·526* ...	30·273*
	20.....	·499 ...	·554
	21.....	·589* ...	·515
	22.....	·486 ...	·419
	23.....	·509 ...	·488
March	1.....	·555 ...	·672
	2....	·788* ...	·782
	3.....	·695 ...	·588
	4.....	·504 ...	·379
June	26.....	·561 ...	·571
	27.....	·600* ...	·590
	28.....	·572 ...	·579
Septembr	25.....	·505* ...	·497
Novembr	2.....	·359 ...	·565
	3.....	·581* ...	·480
	6.....	·475 ...	·532
	7.....	·631 ...	·621
	8.....	·626 ...	·630
	9....	·651* ..	·606
	10.....	·565 ...	·472
	21.....	·521 ...	·591
	22.....	·549 ...	·500
	23.....	·519 ...	·572
	24.....	·681* ...	·642
	25.....	30·546 ...	30·449

1868			
February	9.....	30·546 ...	30·574*
	10.....	·558 ...	·527
	11.....	·503 ...	·558
	12.....	30·548 ...	30·424

February	16.....	30·577* ...	30·495
March	28.....	·466 ...	·605
	29.....	·623* ...	·554
	30.....	·537 ...	·486
Novembr	12.....	·430 ...	·591
	.....	30·653* ...	30·423

1869			
January	9.....	30·547* ...	30·498
	19.....	·522* ...	·507
October	22.....	·503* ...	·468
Novembr	18.....	·552* ...	·501
December	5.....	·470 ...	·586
	6.....	30·589* ...	30·412

1870			
January	17.....	30·521 ...	30·579
	18.....	·608* ...	·577
	19.....	·545 ...	·497
April	4.....	·531* ..	·459
	16.....	·506* ...	·451
June	5.....	·399 ...	·566
	6.....	·541 ...	·471
Septembr	16.....	·532* ...	·521
October	1.....	·538 ...	·551*
	2.....	·526 ...	·505
Novembr	2.....	·530* ...	·517
	3.....	·508 ...	·478
	30.....	·472 ...	·534*
Deeembr	1....	·579 ...	·628*
	2.....	30·604 ...	30·494

1871.			
October	12.....	30·400 ...	30·505*
Decembr	8.....	·508* ...	·446
	12.....	30·520* ...	30·473

1873			
February	15.....	30·423 ...	30·548
	16.....	·632 ...	·646
	17.....	·680 ...	·750
	18.....	·790 ...	·757
	19.....	·726 ...	·641
	20.....	·600 ...	·530
Septembr	22.....	·531* ...	·512
October	21.....	·514* ...	·390
December	1.....	·532 ...	·532
	2.....	·513 ...	·577
	3.....	·610 ...	·614
	4.....	·634 ...	·550
	5.....	·469 ...	·416
	6.....	·415 ...	·560
	7.....	·560 ...	·566
	8.....	·615 ...	·604
	9.....	·603 ...	·533
	10.....	·562 ...	·606
	11.....	·642 ...	30·623
	12....	30·651 ...	

February 18th, 30·812\* at 1 p.m.

# THE ORTHOGRAPHY OF THE WORD EQUATORIAL.

*To the Editor of the Meteorological Magazine.*

SIR,—This matter seems to settle itself. There is not, I believe, a single instance in the English language of a word similarly formed, ending in *eal*.

We have *armorial*, *editorial*, *manorial*, and a hundred others after the same model; indeed, while *ial* is a common termination for adjectives, *eal* is very uncommon; it is used in the case of a few words derived directly from the Greek, such as *empyrean*, *ethereal*.

Perhaps those who write equatoreal will tell us the reason why.

R. B.

December 6, 1873.

## THE NEWBOTTLE WHIRLWIND OF NOV. 30TH, 1872.

BY T. BEESLEY, F.C.S.

*(Continued from page 154).*

The wall is continued along the east side of the next field as far as a ford across a small brook which flows through the ponds at Astrop; but there are no trees along its course here. This wall was broken down in six places—in one place near the ford, for the space of 200 feet—all the stones lying to the west, and affording evidence that the direction of the vortical motion was opposite to that of the sun's course, or the hands of a watch. A short cross wall from the end of this wall to the ford was also broken down. About here the greatest fury of the whirlwind seems to have been spent. The brook runs from north-east to the ford; and every tree along it for 450 yards, is thrown down, broken off, or greatly damaged. The first, a large ash, close to the ford, had its head broken off and lying N.N.W.; a second ash was broken off twelve feet from the ground. Just beyond this, a large elm was thrown across the brook to W.; then three more were topped, and finally, another elm was thrown across the brook to W. Three small trees were injured a little S.W. of the ford; as also a small elm in a hedge at the end of the long wall. From this scene of destruction a stream of branches stretching in a northerly direction across the next field, in some places cutting furrows in the soft turf, points out the course of the whirlwind; but it seems to have rapidly lost its force here, and to have ceased to be a visible object. It may, however, still be traced by slightly damaged trees to the top of the hill east of Rosamond's Bower, where two ricks, which had their thatch partly removed, mark the limits of its path. Between these some trees were slightly broken, and the same damage may be seen for three fields beyond. Just where the road from Farthinghoe Lodge turns northward to Purston, is a cow-shed of rough boards with a thatched roof. Three men had taken shelter here at the time of the storm, and, as the wind came along, the roof was so shaken, that they ran out in a fright. Two miles beyond, at Thenford, a rustic bridge was noticed by a person passing over it to be much shaken, and trees near the pond at Marston St. Lawrence were violently agitated, but no mischief was done.

Landspouts, like waterspouts, seldom come alone. Whilst the three men threshing beyond Newbottle were looking with astonishment at the phenomenon just described, they saw the water of a pool near Mr. F. Dagley's farmhouse, three quarters of a mile east of Newbottle (near "Bunting House" of the Ordnance Map), rise in spray above the tops of the trees, and this, the pool itself being hidden by higher ground, they could not have done unless it had risen at least 60 feet. The water fell again a little further north. Three little boys (William Boyles, John Markham, and George Payne) had just taken dinner to the men, who, seeing that a storm was coming on, had sent them back to Charlton as quickly as possible. Just as they passed the pool, the water rose up into the air. Of course they ran away as fast as they could; but in a little while curiosity got the better of fear;—they looked back and saw the water falling again like rain. They thought the pool was half emptied, but the brook runs through it, so that it soon filled again. Mrs. Mitchell, living in a cottage near the school at Charlton, noticed both whirlwinds:—one going towards Newbottle Spinney; the other after violently agitating the trees near her house, taking the direction of Mr. Dagley's farm, where after drinking at the pool, it seems to have vanished.

It will be seen by reference to the accompanying plan, or to the Ordnance map of the district (No. 45, quarter sheets N.W. and N.E.), that the course of the whirlwind was generally N.N.E., but with a slight curve—more easterly in the early part of its course, afterwards more nearly approaching a northerly direction. The width of the path when first noticed seems to have been about 200 yards; at Rosamond's Bower it must have been double this, but its greatest force was evidently confined within narrower limits, perhaps corresponding to the eastern half of the circle, where the rotary motion conspired with that of progression. Any estimate of the velocity of the former must be very uncertain: the velocity of progression, according to the statements of several observers, that a man running down hill could hardly keep up with it, and from their rough guesses of the time during which they watched it, was probably about a mile in five minutes. It should be mentioned that most of the persons who saw it, with whom I conversed, were intelligent men of their class; and one or two, as the elder Adkins, particularly so.

Every one has seen at corners of streets in gusty weather the little revolving clouds of dust produced by eddying winds; and many have seen in the fields at hay or harvest time the hay or straw, or sometimes even sheaves of corn, whirled in circles high up into the air. These are phenomena of the same kind, but on a smaller scale, as that just described. Occasionally, too, may be seen in the distant horizon funnel-shaped clouds stretching their long pipes to the earth—true "windspouts" made visible by the condensation of vapour, but perhaps hardly dense enough to attract attention from observers nearer to them. Whirlwinds causing much damage are not uncommon—many are recorded in old books on local natural history; but it is believed that

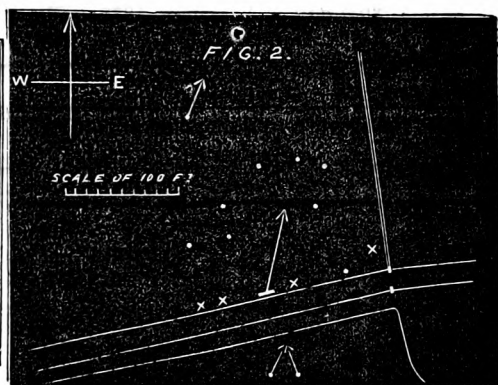
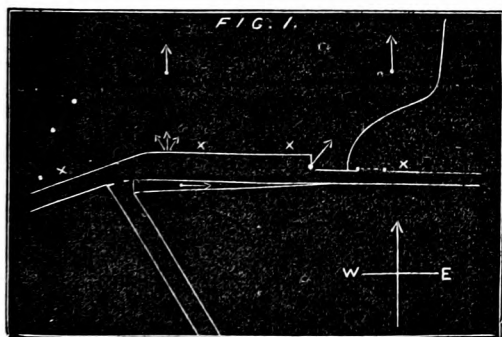
there is no recorded case of one in England, at once so striking in appearance, and so accurately observed, as the subject of the present narrative.

I wish to add, that I am indebted to Mr. Symons for many of the measurements of angles and other observations made during two hard days' work upon the spot together. T.B.

We believe that the previous narrative, in which Mr. Beesley has incorporated the statements of no less than twenty-eight persons, who from sixteen different spots witnessed the progress of this whirlwind, is unique in its authenticity, detail, and conciseness. We promised in our last to add a short postscript to Mr. Beesley's narrative, but its completeness removes the necessity.

The lithograph map is, we think, self-explanatory, except, perhaps, the terms "Pho. IV.," and "W<sup>t</sup> I.," the former indicating the position of the camera when photograph Fig. IV. was taken, and the latter referring to the enlarged woodcut plan Fig. I.; damaged trees are marked with a  $\times$ , both in the woodcuts and in the lithograph; and in the former, sound trees are occasionally marked by circles, to show the narrowness of the path, or the capriciousness with which trees in the full track of the whirlwind were often spared. This is well seen in photograph No. 1,\* which shows the huge beech lying prostrate, and yet, close to its head, several smaller trees absolutely untouched.

The remark by more than one of the men that the "rope," "pipe," or "trunk," which was "shot down to the earth," varied in length, only reaching the ground at intervals, may probably account for this remarkable immunity.



Considerable interest attaches to the weather existent on the day of this whirlwind. The daily weather map for the morning of that day shows a very low sea level pressure (28.4 in.) in the south-west of Ireland, and strong S. wind on its south-east coast. In the neighbourhood of Banbury low pressure (29.0 in.), and light S.W. wind. The fol-

\* Six photographs of the effects were taken at points marked on the plan. The negatives are in the hands of Mr. Herbert, photographer, Horse Fair, Banbury, who will supply copies, post free, at 1s. each, or unmounted at 9d.

lowing are the notes of some of our correspondents, arranged in Divisions in the usual order:—

II. CROWBORO' BEACON OBSERVATORY, Nov. 30, 1872.—Densely overcast and damp morning; more rain last night; rather finer during the forenoon, but heavy rain appeared to be falling both to the E. and W. of us. About 3 p.m. a very heavy shower of R and H with L, and the wind rising again from S.S.E.; bar. has been falling all day, and is now lower than it has been at any time during the month. 9 a.m. 29·137 at sea level. 9 p.m. 28·950.

II. HYTHE. 5.15 p.m., L.—SELBORNE. T & L at 1 p.m.

III. HITCHEN. Heavy T shower.—MAGDALEN COLLEGE, OXFORD. H, R and T.—ADDINGTON, WINSLOW. Five or more peals of T.—THE LODGE, SANDY. Heavy shower and T.

V. BEAMINSTER, DORSET. T at 5 p.m.—TAVISTOCK, KILWORTHY HILL. Cloudy, T L, R and H.—DRUID, ASHBURTON. 7 a.m. T and L, min bar.—COURT BARN, CLAWTON. T.—POUGHILL VICARAGE,—29th L, 30th bar. lowest for several years, not followed by any storm.

VI. SANSAW HALL. Unaccountable depression in the bar., followed by no variation in weather from 28th to 2nd Dec.—ORLETON. Heavy R in night, showery, L seen at, and distant T heard before 8 a.m.; showery till noon, then fine with clouds and great wind; bar. low, 28·48 at 9 p.m.

VII. BOSTON. Stormy all day, with heavy showers.—GRIMSBY. Very low bar.

IX. LOCKWOOD BECK.—A fine morning, showery afternoon.

XX. FERMOY. Fair.—BRUCE VILLA, CLONMEL. Storm, aneroid 28·35.

We have also been favoured with the following extract, but except in the shift of the direction of the wind, and in the record of the hail showers, no indication is apparently afforded by these observations. We have added the equivalent sea level pressure to facilitate comparison.

*Photo-Meteorological Observations recorded at the Radcliffe Observatory, Oxford, on 30th day of November, 1872. Extracted (at the request of Mr. Symons) from the two-hourly Register.*

Date.	Barograph reduced to 32°	Thermograph.	Anemograph Direction of wind.	Anemograph 2 hours velocity of wind.	Sea Level Pressure.
	inches.	deg.		miles.	inches.
Nov. 30th, 2 a.m. ...	28·852	47·0	W. b. S.	31·2	29·076
„ 4 „ ...	28·852	44·5	S.W.	26·4	29·077
„ 6 „ ...	28·824	42·8	S.W.	16·8	29·049
„ 8 „ ...	28·796	44·5	S.S.W.	24·0	29·020
„ 10 „ ...	28·782	46·5	S.S.W.	27·6	29·006
„ noon .....	28·739	49·0	S.W.	27·6	28·961
„ 2 p.m. ....	28·696	44·8	S.S.W.†	20·4	28·920
„ 4 „ ...	28·640	44·8	S.S.W.	28·8	28·864
„ 6 „ ...	28·611	46·5	S. b. W.	25·2	28·835
„ 8 „ ...	28·583	48·2	S.S.W.	34·8	28·806
„ 10 „ ...	28·569	47·6	S.S.W.	36·0	28·792
„ midnight..	28·583	47·0	S.W.	39·6	28·806

† At 1 p.m. W. b. S.

Rain fell on Nov. 29th, from 6 p.m. to 10 p.m., to the amount of 0·13 in.; nad from noon to midnight on Nov. 30th, to the amount of 0·41 in. Hail fell Nov. 30th, at 0.20 (noon), and at 1.20 p.m. In the first instance, the temperature fell about 1°·5, and in the second about 3°·5.

ROBERT MAIN.

From these the general character of the weather may easily be gathered—but still more interesting is the following note, for which we are indebted to Mr. R. H. Scott, F.R.S.

“At Yarmouth, in the evening of November 30th, the velocity suddenly rose from 20 to 52 miles an hour, without any serious change of direction, and as suddenly fell again. The velocity of 52 miles was registered between 10.30 and 11.30 p.m. from S.E. by S, but it was almost entirely due to a violent squall at 11.5, which must have far exceeded that velocity as long as it lasted.”

Mr. Beesley truly remarks that “Landspouts, like waterspouts, seldom come alone;” and though, of course, we do not suggest any *direct* connection between the Newbottle whirlwind and the Yarmouth squall, it is strongly confirmatory of the theory that there are often several small squalls of great intensity, travelling along with the greater atmospheric movements—eddy, in fact, in those cyclonic systems which often simultaneously affect many thousand square miles.

Lastly, there are several lessons in this narrative. We do not hesitate to quote it as a specimen of how such phenomena should be investigated and recorded, that Mr. Beesley, in spite of a host of difficulties (*e.g.*, plan drawing in ploughed fields in wet December weather), has left a pattern which we trust will be implicitly followed by those of his brother-observers who may have the good fortune to have opportunities of recording similar facts.

The thanks of meteorologists are also due to T. L. M. Cartwright, Esq., and Sir W. R. Brown, Bart., for their thoughtfulness in ordering that not a stone should be replaced, nor a tree moved, until all necessary measurements and photographs were taken.

[We regret that owing to circumstances beyond editorial control, it was impossible to send proof of the first portion of this article to the author, and that the printing was not up to our usual standard. The only misprints which affect the sense are (1) page 151, line 7, after “elevation” insert “and”; (2) on the same page the quotation from Lucretius should have been marked as a foot note to the word “cloud” in the 36th line; (3) on page 152, line 36, omit the first word, and the next line should begin “one at.”]

## THE BRITISH ASSOCIATION AT BRADFORD.

(Concluded from page 158.)

### G. M. WHIPPLE ON A NEW SELF-RECORDING ELECTRICAL ANEMOGRAPH.

Among the many instruments which have been devised for recording continuously and automatically the velocity and direction of the wind, none appears to have met with more general approval than the form known as the Beckley or Kew Pattern Anemograph.

This instrument was originally constructed in 1857 by a grant from the British Association, and a detailed description with plates is to be found in the published report of the 1858 meeting.

Some minor modifications found desirable having been introduced in the instrument it was accepted by the Meteorological Committee for employment in their observatories, and the improved anemograph is fully described in the report of the committee for 1867.

The essential features of the instrument may be thus described.

It consists primarily of two parts. First, a velocity recorder and secondly a direction recorder.

1st. *Velocity recorder*.—A system of Robinson's cups puts a vertical shaft in motion, the movement of this being suitably reduced by wheelwork, is transmitted eventually through shafting to a spiral pencil, which in rotating marks upon suitably prepared paper wrapped round a drum, revolving continuously at a uniform rate.

Lines drawn upon the paper serve to indicate the velocity of the wind passing over the instrument at any given instant.

2nd. *Direction recorder*.—A windmill vane mounted immediately below the Robinson's cups, like them gives motion to a vertical shaft, which is directly connected to a spiral pencil similar to that recording the velocity, and fixed beside it. The gearing is so arranged that this pencil makes a complete rotation, marking from one extremity of the scale to the other, for every revolution of the vane, indicating thereby the veering of the wind from north round to north again.

Experience has shown that under most conditions the working of this instrument leaves but little to be desired, but that in situations where it is necessary to place the recording apparatus at a considerable distance from the external or driving part of the instrument, its action is subject to irregularities, due principally to the shafting necessarily employed under such conditions. And it is to meet such cases that the instrument now suggested has been devised.

There is no novelty involved in the adaptation of electricity to the purpose of wind registration. Numerous arrangements by which it may be accomplished have been made, amongst others Secchi's, Crossley's, Gordon's, and Hall's are familiar to most meteorologists.

In the new instrument, for the velocity recording, where rotation in one direction only is required, a simple contact key is fixed to the shaft on which the Robinson's cups are mounted. This transmits a short current every time the cups complete a revolution, through a wire which is led to the recording apparatus, intermediate shafting being abolished.

The successive currents then, by means of an arrangement resembling that which obtains in step by step telegraph instruments, produce continuous rotation of a wheel which being in connection with the train at present existent eventually drive the pencil round, and record the wind's movement upon the paper.

*Direction*. The registration of the direction of the wind by means of electricity is rendered a problem more difficult of execution than the velocity, by reason of the fact that rotation of the wind vane occurs sometimes in the one direction, from north through east to south and sometimes in the opposite, from north through west to south.

Numerous plans have been devised for accomplishing the desired registration, requiring wires varying in number from four to sixteen. In the instrument now described but two are requisite, one of which is employed to transmit the rotary movement of the vane to the recording pencil, whilst the other determines the direction in which the rotation is to take place.

A toothed wheel in electrical communication with a battery is fixed upon the vane spindle and so arranged that a current is passed to the recording apparatus every time a tooth touches the contact piece.

Every current transmitted causes a wheel in the registering apparatus to turn through a certain small arc, always, of course, in the same direction.

In order to record backing of the wind the second wire is made use of.

Above the contact making wheel on the vane shaft an insulated metallic collar is fitted, turning loose on the shaft, from which a small stud projects which plays between two stops on the collar. One of these stops is a conductor whilst the other is insulated. The play of the stud between the two stops is only sufficient to make and break the electric current.

The wire leading from the stop is conducted to an electro-magnet fixed above the recording apparatus, and the effect of the passage of a current through the wire is to cause the armature of the magnet to move through the agency of a crank a slide upon which two mitre wheels are fixed (as in the ordinary reversing clutch) these being brought into gear either on the one side or the other of the



mitre wheel driving the pencil, cause it to rotate in a direct or retrograde direction.

Under ordinary circumstances the upper mitre wheel will be kept in gear with the pencil shaft by the action of a spring, and the vane stud will remain in contact with the insulator, but when the wind "backs" the stud comes in contact with the metallic stop and permits the electric current to pass. The electromagnet then comes into action and lifts the sliding axis, thereby bringing the lower mitre wheel into gear with the pencil shaft. This being the case the rotation of the wheel by the other electric current still goes on tooth for tooth as the vane turns, but the lower wheel being the driver as long as rotation continues in the retrograde direction so long the pencil will turn that way, and the paper on the cylinder will record a "backing" of the wind.

Probably the electrical machinery may require the assistance of a spring or weight to assist in overcoming the friction of the pencil against the paper, but no difficulty need arise in applying such, the shaft always turning one way.

The battery power requisite to work the electrical anemograph will not be large, but no instrument having yet been constructed, it cannot be stated.

### A LOCAL THUNDERSTORM.

*To the Editor of the Meteorological Magazine.*

SIR,—A few notes of the thunderstorm which passed over this village yesterday afternoon, October 24th, may be of interest, as though extremely local it was one of exceptional intensity, and by far the severest we have experienced here in the present year. There had been gradually increasing electric disturbance for some days, and on every night of the week, except Sunday, lightning-reflections had been seen in the large tabular masses of frozen nimbus which lay around the horizon.

The morning was nearly clear, and the atmosphere calm. Thermometer exposed in shade  $31^{\circ}$ , on grass  $29^{\circ}$ ; barometer at 9 a.m. 29.23 (corr. and red.) Cirrus and composite cloud-bank lay round the W. horizon, with intermingled thunder-clouds; and this gradually worked over, the sky continuing clear in N.E. At 11 a.m. there was very distant thunder in W.N.W., and at 11.30 louder thunder in S.S.W. Then fell a sharp shower, but the sky shortly cleared again in the W. Throughout the afternoon a splendid range of distant thunderstorm extended from N.N.E. to E.N.E. About 3.30 a distant shower appeared in S.W., its summit soon running out in long lines of cirrus nearly to the zenith. A little before 4 there was one distant thunderclap in S.S.W., from which quarter the clouds were slowly rising. Just before sunset the storm began to form rapidly in S.W., about five miles off, the base of the cloud becoming continually lower until it seemed nearly to touch the earth. At 4.50 the discharges suddenly beame frequent over Breinton Common, in the immediate W.N.W. I was standing on high ground in a field, from which the storm could be watched to great advantage. The lightning was now most intensely white and brilliant, especially where the flashes struck the earth's surface. A flash, the time-interval of which was three seconds, was immediately followed by an excessively vivid one, which fell in an orchard opposite me, time-interval about one second. This flash injured, but not seriously, as I am informed, a girl who was

gathering apples under the trees. The next flash was still closer, and accompanied by a tremendous report. The claps were all excessively sharp and short, bearing more resemblance to the sound which might be produced by the instantaneous smashing of a large quantity of glass than to anything else. Large hailstones continued to fall during the storm, which ceased suddenly at 5.30, the sky becoming cloudless in S.W. and W. The total diameter of the storm at its greatest intensity was only  $3\frac{1}{2}$  miles. The nimbus seemed to become dissipated shortly after it had passed over to N.E.

The cirrus current was from S.W. in the morning and rather slow, though more rapid than the lower currents. Clouds of less altitude travelled all day slowly from S. by W. and S.S.W. There was a constant dead calm on the earth's surface, except in the storm, when a N. breeze prevailed.

About dusk the distant thunderstorm (a totally distinct one), which had hung for hours in the N.E., was illuminated by occasional lightning, and there was also vivid lightning until 8 p.m., at intervals of four and five minutes, in a nimbus in the far N.N.W. Later in the evening I noticed lightning-reflections in W.N.W., and one or two in S.S.E.—Yours truly,

W. CLEMENT LEY.

*Breinton, Hereford, Oct. 15, 1873.*

P.S. October 26. The frost this morning was of rather unusual severity. Temp. min.  $23^{\circ}$ , on grass  $19^{\circ}$ .

## THE OCTOBER FROST.

*To the Editor of the Meteorological Magazine.*

SIR,—I know not what Mr. Brumham may have in store for us, but the continued low temperature of the last eight days of October in this locality are, I think, almost without precedent—at any rate, of late years. Perhaps the following figures may be found of interest for comparison with those recorded elsewhere. Thermometers placed on the bole of a tree in the open field, and protected from the sun, rain-fall radiation, and 5 feet above ground:—

Date.	Min.	Max.	Mean of day.	Rainfall.
Oct. 24.....	30	53	41.5	0.00
25.....	28	51	39.5	„
26.....	30	52	41.0	„
27.....	29	51	40.0	„
28.....	25	51	38.0	„
29.....	24	48	36.0	„
30.....	26	45	35.5	„
31.....	30	50	40.0	„

Very thick fog till 1 p.m. on 30th.—I am, Sir, yours truly,  
WILLIAM CARTER.

*Bucknall, Horncastle.*

## BALLOONS AND UPPER CURRENTS.

*To the Editor of the Meteorological Magazine.*

SIR,—A San Francisco (Cal.) paper I have just received gives an account of a balloon ascent made from that city on the 18th of October. The heads of this may be of interest in connection with the above.

For one mile the balloon rose swiftly upwards, in an almost *straight line*. It then drifted slowly *to the westward*. It next struck an easterly current and passed over the city in a *north-easterly direction*. From this it struck a *westerly current*; but, suddenly, as the balloon rose, the wind of the upper air changed, and it was driven rapidly *towards the east*. At one and a-half miles high, the course was still *steady towards the east*, and “the great theory of an eastern current seemed about to be established.” Within two minutes, however, the balloon began to verge *towards the westward*. As this meant the open sea, descent was attempted, but missed; and a higher level tried for a change of current. At three miles up the balloon struck a current blowing direct *towards the east*. With this they hoped to carry over the land; but suddenly, the balloon commenced falling with frightful rapidity, and finally plunged into the Pacific, whence the aeronauts were rescued by some boatmen, after severe exertions.

From this it will be seen that such diversities of currents are peculiar to other lands than ours. At Quebec, on the 21st, there were two distinctly opposing currents—(S.W. over N.E.)—with gale and showers of rain. In London, on the 18th, my own records give W. and N.W. winds 19th, N.; 20th, S.W. and N.; 21st, S.W. and N.W.; to S.W. on 22nd. I also have a recollection of an ascent by Mr. Glaisher, a few years ago, passing successively through four opposite currents. On one occasion also, watching the sky, I saw the strange phenomenon of clouds from the four cardinal points, which all met and passed each other in the zenith. At another time, I saw the adverse currents so near, that two masses of rain-cloud from N. and S. passed each other within a few degrees distance, at racehorse speed.

In conclusion, I may say that this diversity of current is not rare, and may frequently be observed in the weather tables of the *Times*. Some years ago their singularity struck me, and their investigation led to some singular results in the foreseeing of weather. One of these results may be seen in the singular barometric elevation of the 27th ult., and the heavy London fogs arising from the shifting, mingling, currents—N., E., S. to N.—I am, Sir, yours, &c.,

R. M.

*London, November 17, 1873.*

## NOVEMBER, 1873.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which -01 or more†	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	inches.			in.			Deg.	Date.	Deg.
I.	Camden Town .....	1·87	—	·54	·44	5	14	58·1	23	27·7	13	3	6
II.	Maidstone (Linton Park) .....	1·73	—	1·46	·28	1	17	60·0	23	28·0	13	4	...
	Selborne (The Wakes) .....	2·61	—	·93	·55	5	15	53·5	23	27·0	4	6	9
III.	Hitchen .....	1·87	—	·27	·47	2	16	52·0	22*	25·0	12	8	...
	Banbury .....	1·13	—	1·07	·28	2	14	56·0	22†	27·5	4	6	...
IV.	Bury St. Edmunds (Culford) .....	2·00	—	·39	·38	2	16	54·0	22	25·0	12	9	11
V.	Bridport .....	4·28	+	1·12	·92	2	15	57·0	23¶	27·0	21	2	...
"	Barnstaple .....	2·14	—	2·00	·38	26	22	57·0	27	33·0	21	0	...
	Bodmin .....	6·06	+	1·08	1·66	5	23	58·0	22	31·0	12	2	3
VI.	Cirencester .....	2·07	—	·72	·51	5	14	...	...	...	...	...	...
"	Shiffnal (Haughton Hall) .....	1·60	+	·03	·41	5	16	57·0	25	29·0	16**	7	7
"	Tenbury (Orleton) .....	1·59	—	·88	·48	7	15	59·2	22	27·0	16	8	8
VII.	Leicester (Wigston) .....	1·97	—	·19	·50	6	14	57·0	22	30·0	12††	8	...
"	Boston .....	1·08	—	1·06	·20	6	15	55·0	22	30·0	13	2	...
"	Grimsby (Killingholme) .....	1·36	...	...	·22	5, 7	14	55·0	22†	34·0	13††	0	...
"	Derby .....	2·03	+	·40	·45	6	19	56·0	22	32·0	4	1	...
VIII.	Manchester .....	2·28	—	·48	·33	27	13	55·8	22	27·0	16	3	11
IX.	York .....	1·45	—	·53	·68	6	12	57·5	28	30·0	13	4	...
"	Skipton (Arncliffe) .....	4·66	—	1·79	1·00	6	19	52·0	26	27·0	30	...	...
X.	North Shields .....	1·30	—	1·40	·31	6	18	57·5	22	32·0	4§§	3	6
"	Borrowdale (Seathwaite) .....	10·06	—	6·61	2·17	26	15	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	2·48	—	1·76	·76	5	13	...	...	...	...	...	...
"	Haverfordwest .....	3·44	—	2·23	·70	1	17	55·0	22§	28·0	15	6	9
"	Rhayader (Cefnfaes) .....	3·30	—	1·28	·70	29	12	54·0	...	31·0	...	...	...
"	Llandudno .....	1·68	—	1·48	·36	26	13	57·5	26	31·0	16	...	...
XII.	Dumfries .....	1·83	—	1·39	·36	25	17	56·0	22	25·0	16	8	...
"	Hawick (Silverbut Hall) .....	2·37	...	...	·73	6	13	...	...	...	...	...	...
XIV.	Kilmarnock (Annanhill) .....	2·22	...	...	·48	25	14	53·4	29	25·0	16	6	12
XV.	Castle Toward .....	5·19	+	·55	1·05	25	14	54·0	23	...	...	...	...
XVI.	Leven (Nookton) .....	1·97	—	1·07	·55	6	16	53·0	22	26·0	3§§	10	23
"	Stirling (Deanston) .....	2·91	—	·60	·61	25	21	53·0	28	22·0	16	12	18
"	Logierait .....	1·38	...	...	·26	29	11	55·0	21¶	20·0	15	13	...
XVII.	Braemar .....	4·82	+	2·00	2·14	6	18	50·7	28	19·0	13	12	19
"	Aberdeen .....	4·57	...	...	2·73	6	16	53·1	26	27·8	5	4	13
XVIII.	Inverness (Culloden) .....	3·18	+	·56	·63	1	16	52·6	28	31·9	15	2	21
"	Portree .....	9·52	—	·96	1·43	26	20	...	...	...	...	...	...
"	Loch Broom .....	5·16	...	...	·90	22	16	...	...	...	...	...	...
XIX.	Helmsdale .....	2·84	...	...	·74	27	14	...	...	...	...	...	...
"	Sandwick .....	4·69	+	·69	1·16	21	18	50·8	28	31·3	5	1	11
XX.	Caherciveen Darrynane Abbey .....	4·41	...	...	1·00	4	24	...	...	...	...	...	...
"	Cork .....	2·52	...	...	·76	4	15	...	...	...	...	...	...
"	Waterford .....	3·17	—	·78	·68	4	19	60·0	28	29·0	3	3	...
"	Killaloe .....	3·19	—	1·70	·53	26	16	57·0	24	27·0	2	3	6
XXI.	Portarlington .....	2·13	—	1·79	·39	1	25	55·0	22	25·0	15	6	...
"	Monkstown, Dublin .....	1·85	—	1·04	·45	13	13	56·0	2	20·5	3	5	...
XXII.	Galway .....	2·92	...	...	·65	5	18	57·0	23	29·0	2, 16	2	...
"	Buninadden (Doo Castle) .....	1·86	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Waringstown .....	2·00	...	...	·41	5	16	57·0	15	27·0	15	8	16
"	Edenfell (Omagh) .....	2·09	...	...	·42	5	15	54·0	24	25·0	15	13	...

\* And 23 &amp; 29. † And 23. ‡ And 29. § 25 &amp; 26. ¶ 28. || 22.

\*\* 21.

†† 13.

‡‡ 16.

§§ 5 &amp; 16.

¶¶ 17.

|| 22.

+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, STAPLEHURST.—A fine, mild, and mostly dry month after 10th rendering the roads almost dusty; slight frosts only on 4th, 12th, 13th, and 21st; L on night of 26th and 27th; winds mostly S. and W., and brisk, but not high, on 9th, 15th, 22nd, and 29th. Bar. generally high in the middle of month. Geraniums and similar plants out doors still fresh and growing, and the thrushes and other birds frequently singing as if in April. Fine and dry as the past month has been, I think that the total R is above that of many years in November, but the fact of less than half-an-inch falling during the last twenty days of the month, the unusual absence of fogs, and a very mild atmosphere, have tended to render it one of the most agreeable months on record, and there having been much less frost than in October, vegetation is still in progress.

SELBORNE.—23rd bright meteor seen in N.W. at 7 p.m., leaving a brilliant train. Wind first week S.W. and W. from 8th to 20th, N. and N.E. afterwards, mostly W., very high during the last week. Swallows seen at Chawton House, four miles hence, on 12th, and martins on the 21st; thrushes singing daily to the end of the month. The period of the swallows and martins' disappearance is much later than I have ever known; the latest time recorded by Gilbert White is November 5th. The month on the whole has been favourable, both for fields and gardens. I saw lambs on the 28th.

BANBURY.—High winds on 8th, 9th, 21st, 22nd, 23rd, and 29th; on 22nd, between 11 and 12 a.m., considerable damage caused by gusts of wind from N.W.; trees blown down or broken, and roof of G.W.R. station injured.

CULFORD.—The weather throughout the month has been comparatively mild and singularly free from fogs; easterly winds prevailed on twelve days, and westerly on eighteen; H fell on the 2nd, and high winds prevailed on the 22nd, 23rd, and 29th.

BRIDPORT.—Heavy gale on 1st, accompanied with furious gusts of wind with R and H; gales on 9th and 26th.

BODMIN.—Erratum. Max. for October should have been sent as 68°.

SHIFFNAL.—R daily, with one exception (2nd), till the 11th; either fog or mist most mornings, and the sun seldom visible during the month; the last half much milder than the first, for up to the 21st the max. never exceeded 48°, the average being 44°·5; strong wind from E. and N.E. on 8th, 9th, 10th, and 11th; on 21st the temp. suddenly rose from 44° to 54°, followed by a heavy storm from N.W. on 22nd from 2 to 4 p.m., and again at night; F succeeded next day, and on 25th the temperature again suddenly rose from 49° to 57°, followed by strong wind from W. till the 30th; average max. of this period 51°·5; bar. most unsettled throughout.

ORLETON.—A dry month; very favourable for farming operations, but the sky generally cloudy. R fell on every day except one till the 10th, and very little afterwards; temp. generally steady, and the mean rather more than 2° above the average of the month. The max. 59·2 occurred about midnight on the 22nd, and was followed by a very rough wind. The wind was high again on the 29th. Bar. high, 30·30 on 16th. No T or L during the month.

WIGSTON.—An unusually fine month, which has therefore proved most favourable for wheat sowing.

BOSTON.—6th stormy on E. coast; 7th wrecks in Boston deeps; remarkably fine weather all the month; most beneficial season for farming operations known for many years; temp. 2°·7 above the average, and rainfall considerably below it; several very stormy nights towards the end of the month, on the 21st and 22nd especially; polar wind on 16, equatorial on 14 days.

GRIMSBY.—Upon the whole a remarkably fine month, high winds at the close; November of 1857 was very similar; it then continued very mild through December, but January and February of the following year were severe; November,

1867, was also very fine and dry, and water was scarce in many places. T S at 4.30 p.m. on 3rd; high wind on 1st, 21st, 22nd, 23rd, and from 26th to 29th.

MANCHESTER.—The rainfall here has been greatly below the average of a long period; H on 1st and 7th; lunar halo on 2nd.

ARNcliffe.—Violent winds from the W. from 23rd to 30th.

NORTH SHIELDS.—Fine mornings and cloudy afternoons.

SEATHWAITE.—Fifteen days without rain, and only six days on which the fall exceeded half an inch; S on the 1st and T S on 2nd.

#### W A L E S .

HAVERFORDWEST.—This month has had its usual characteristics of gloom, fog, and R; rather mild; 22nd and 29th very stormy; scarlatina has made its appearance in a rather mild form so far.

CERNFAES.—The month has been mild and temperate, prevailing winds N.W. and N.E.

LLANDUDNO.—Frequent H showers, with wind on 1st; S on the distant hills during all the first week; the month has been dull and foggy, unlike the usual November weather here, although on some days the sun has been bright and warm.

#### S C O T L A N D .

DUMFRIES.—The first week showery, with occasional frosts at night; from 10th to 21st dry, the longest period without R since the end of April. In May only four consecutive days without R, the same number in June; in July not two together, and only five in the month; in August only four days without R, and these in different weeks; in September six days in the first week, and five in the third; in October five days dry in the last week; in November eleven days at one period; temp. slightly below that of last November. The latter part of the month showery, with frequent gales of wind.

SILVERBUT HALL.—Frost, S, sleet, and high wind on 1st; red butterfly flying about on 15th. A favourable month for getting forward husbandry operations; from 21st to 29th strong westerly winds, the gales falling away in the daytime and gathering force in the night.

KILMARNOCK.—Prevailing winds easterly, the point of greatest frequency being E.N.E. The greatest pressure took place on the 28th, when a violent gale blew up from the N.W.; from the 21st to the 29th the weather was very unsettled, several severe gales taking place, usually in the night, causing great destruction of life and property, both on land and sea. On the night of the 27th the November meteors were not seen, although at 9 p.m. the sky was quite clear, yet by midnight it clouded over and nothing was to be seen.

CASTLE TOWARD.—Rarely have we such favourable weather for all kinds of outdoor work as we have had during this November; so much has been done that labour is well a-head of the season. Prevailing winds E.N.E., latter part of the month W.S.W.; gale on 22nd, and flood on 26th; heavy R on the previous day.

DEANSTON.—A more favourable month than the last, and more clear and fresh than this month generally is. Strong gales on the 7th, 22nd and 23rd; farming operations in a forward state.

ABERDEEN.—H on 1st, 5th, and 8th; L on 2nd, 3rd, 4th, 16th, and 23rd; auroræ on seven nights; heavy floods, especially in smaller streams near the coast on the 7th, fall of 2.73 in. of R on previous day, and S on the hills; bar. pressure below the mean, temp. and rainfall above it; winds from N.E. and N.W. more prevalent than usual, estimated pressure under the average; a month of mild, but rather dull unsettled weather; frequent gales during the first and last weeks.

PORTREE.—First week wet and stormy, with S on high ground; second week fine, enabling the farmers to finish the harvest in good condition; the crop is much above the average, potatoes abundant and of excellent quality; latter part of month very wet and stormy. A continuous gale from W. from 12 p.m. on 21st to 2 p.m. on 23rd, and another heavy gale from S.W. on 27th.

LOCHBROOM.—The best month since June; we had eleven fine days following each other, which we have not had since May; but we have had severe gales, heavy R along with S on the hills, and frost in the straths.

**SANDWICK.**—The first part of November was remarkably fine, with the exception of the 1st, when a sudden gale came on of 50 and 55 miles an hour, and 0·45 in. of R fell, but from that day to the 20th only 0·22 in. of R fell, while there fell 4·02 in. during the last eleven days, and there were gales on 22nd, 23rd, 24th, 27th, 28th and 29th.

#### I R E L A N D .

**DARRYNANE ABBEY.**—Frost on 2nd, H on 1st and 7th, wind from 4th to 20th chiefly N.E., varying to E. and S.E., rest of the month mostly N.W.

**MONKSTOWN.**—With the exception of the early part, in which there was some smart frost, the month was mostly dry and dark, with very slight variation in temp. during the 24 hours.

**DOO CASTLE.**—Remarkably fine month.

**WARINGSTOWN.**—Fine and dry, great progress made with wheat sowing ; temp. above the average.

**EDENFELL, OMAGH.**—With the exception of the last week the month has been remarkably fine and mild, and very favourable for farming operations.

### THE COMING WINTER AND SUMMER.

*To the Editor of the Meteorological Magazine.*

SIR,—According to several laws it appears nearly certain that the coming winter will be rather severe, and that the Greenwich mean temperature of the winter, will be colder than the average of the last 33 years. I expect that the minimum temperatures of January and February, at Greenwich (which were respectively only 26° and 25° in those months in 1873), will be considerably lower in 1874, although the mean of February may not be so low as in last winter. April, too, will probably be somewhat colder than the average of the last 12 years, at least in mean temperature. It also appears almost certain that we shall have a cool summer, generally ; indeed, cooler than last summer was, owing to the probable absence of such extremely high maxima (on a few days) as in 1873.

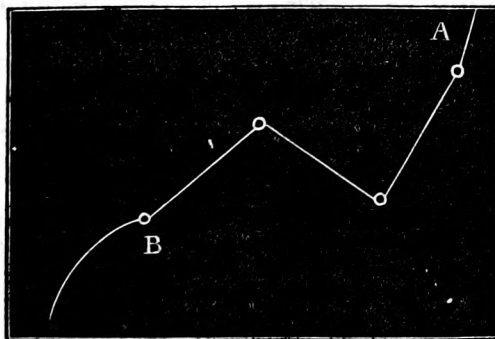
GEORGE D. BRUMHAM.

*Barnsbury, November 29, 1873.*

### REMARKABLE FORM OF LIGHTNING.

*To the Editor of the Meteorological Magazine.*

SIR,—I send you a sketch of a very remarkable form of lightning which I observed during the severe storm of August 24th. The cloud



from which this form of lightning emanated came off the sea over

Beachy Head, and travelled across the Weald to the westward of this Observatory in the direction of London. I quite satisfied myself of its peculiar form by constantly watching for every flash which occurred in the course of half-an-hour. The first break in the lightning occurred apparently very near the cloud at A, while at B it assumed a curved form before it descended to the earth. Two oak trees were struck and a cow was killed in this immediate locality.—Yours truly,

C. L. PRINCE.

*Observatory, Crowborough Beacon, Tunbridge Wells.*

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### BOOKS RECEIVED.

#### BARBADOES.

RAWSON, THE HON. R. W.—“Rainfall Returns and Diagrams—February to September, 1873.”

#### BELGIUM.

CAVALIER, M. J.—“Résumé des Observations Météorologiques faites à Ostend en 1862—70,” 4to.

#### CANADA.

KINGSTON, G. T.—“General Meteorological Register for 1872,” 8vo.

#### DENMARK.

HOFFMEYER, CAPT.—“L’Institut Météorologique Danois—Daily Observations, April to October, 1873,” oblong 4to.

#### FRANCE.

“SOCIÉTÉ MÉTÉOROLOGIQUE DE FRANCE—Annuaire, Tome Dix-Huitième, Tableaux, Feuilles, 1—6.”

#### GREAT BRITAIN.

HARTNUP, J.—“Report of the Astronomer to the Marine Committee, Mersey Docks and Harbour Board, 1871”—Liverpool Printing Company, 1872. 8vo.

MAIN, REV. R.—“Results of Meteorological Observations at the Radcliffe Observatory, Oxford, in 1870.” J. Parker and Co., 1873, large 8vo.

METEOROLOGICAL COMMITTEE.—“Report of the Meteorological Committee of the Royal Society for 1872.” Spottiswoode, 1873, 8vo.

MARLBOROUGH COLLEGE NATURAL HISTORY SOCIETY.—“Seventeenth Half-Yearly Report.” Perkins, Marlborough, 1873, 8vo.

LEWIS, J.—“Digest of the English Census of 1871.” Stanford, large 1873, 8vo.

MELDRUM, C.—“Notes on the Form of Cyclones, &c.” [Reprinted from Monthly Notices, Meteorological Society Mauritius, by the Meteorological Committee.] Stanford, 1873, 8vo.

METEOROLOGICAL COMMITTEE.—“Contributions to our Knowledge of the Meteorology of the Antarctic Regions.” Stanford, 1873, 4to.

ALDRIDGE, E. G.—“Temperature at Ventnor, Helston, and Greenwich—Annual Maximum and Minimum 1848—72.” Single sheet, 4to.

#### INDIA.

CHAMBERS, C. F.R.S.—“General Remarks on the Climate of Bombay.” 8vo.

#### ITALY.

RAGONA, [PROF. D.—“Rapporto alla R. Accademia di Scienze, Lettere, ed Arti di Modena sull’opera intitolata Astronomical Observations made at the Royal Observatory, Edinburgh, Vol. XIII.”—Luigi Gaddi, Modena, 1873, 4to.

“Sulle Pioggie di Ottobre, 1872.”

#### UNITED STATES.

DRAFER, D.—“Report of the Director of New York Meteorological Observatory for 1872,” W. C. Bryant and Co., New York, 8vo, 1873.



# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

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XCVI.]

JANUARY, 1874.

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### INTERNATIONAL METEOROLOGY.

Two very important steps have been taken since our last issue; they have entirely different objects, have no connection one with the other, have their origin one in the New and one in the Old World, and yet are most appropriately treated under the single heading we have given above.

#### SYNCHRONOUS WEATHER CHARTS OF THE WORLD.

A twelvemonth since,\* when highly praising a publication of the Meteorological Committee, we urged them to give us daily weather maps of the Atlantic Ocean. They did not do so, and probably it is well they did not, for our Transatlantic friends have now inaugurated an even bolder scheme. At the Vienna Congress, last September, the energetic Superintendent of Weather Telegraphy in the United States, Brigadier-General Myers, submitted the following proposal:—

That it is desirable that, with a view to their exchange, at least *one* uniform observation of such character as to be suitable for the preparation of synoptic charts be taken and recorded daily and simultaneously at as many stations as practicable throughout the world. †

This scheme is now in operation, the time selected being that corresponding to 0·45 p.m., G.M.T. in London, or noon in longitude 11° W.; by the selection of this epoch it will fall in the night and early morning hours in the United States, where the observations will be made by General Myers' own staff, and in the day time over the whole of Europe and Africa, as well as the greater part of Asia. Observers resident in localities far removed from fixed observatories, and who are willing to assist, should volunteer at once,‡ as the system was inaugurated on Jan. 1, 1874, and daily charts are now in process of preparation.

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\* Met. Mag., vol. vii., p. 205, January 1873.

† Bericht, p. 58.

‡ Information as to the requirements can be obtained from Brigadier-General Myers, Signal Office, Washington, or R. H. Scott, Esq., F.R.S., Meteorological Office, Victoria-street, London, S.W.

## CLIMATOLOGICAL SUMMARY FOR THE BRITISH EMPIRE.

Under this head we have to note a less ambitious proposal than the above, but one of which it is not easy to foresee the probable development. Owing to certain correspondence published in "*The Colonies*," the proprietors of that periodical have resolved upon attempting to publish monthly synopses of the weather at between twenty and thirty widely-separated stations.

The information which it is intended to publish monthly for each station is the following :—

Shade temp. Absolute maximum and its date  
 Shade temp. Absolute minimum and its date  
 Shade temp. Average maximum  
 Shade temp. Average minimum  
 Mean temperature of Dew Point  
 Mean degree of Humidity  
 Absolute maximum in sun and its date  
 Absolute minimum on grass and its date  
 Total depth of Rain and the number of days on which it fell  
 Average amount of Cloud  
 And copious Remarks.

The organization is to be carried out under the supervision of Mr. Symons, and will probably embrace many, or most of the following cities or localities :—London, Calcutta, Bombay, Madras, Aden, Ceylon, Labuan, Singapore, Queensland, Sydney, Melbourne, Adelaide, West Australia, Hobart Town, Wellington and Christchurch in New Zealand, Mauritius, Natal, Cape of Good Hope, British Columbia, Newfoundland, Halifax, Toronto, British Honduras, and Barbadoes.

It is far too early to say more with regard to either of these new schemes than that each in its separate sphere is likely to be of considerable service, and merits the support of all who have the advancement of Meteorology at heart.

## THE ORTHOGRAPHY OF THE WORD EQUATORIAL.

*To the Editor of the Meteorological Magazine.*

SIR,—Your correspondent R. B., in writing on the orthography of the word *equatorial*, concerning which there had been raised a question as to whether it should end in *eal*, or in *ial*, says :—"There is not, I believe, a single instance in the English language of a word similarly formed ending in *eal*." He mentions *empyrean* and *ethereal*; but these appear from his letter to be excluded from the argument on account of their being derived directly from the Greek. He might have added, and probably did intend to exclude, *boreal*, *heterogeneous*, *homogeneous*, *hymeneal*, and *purpureal*. But what has he to say respecting the following adjectives, which are certainly not derived directly from the Greek :—*corporeal*, *cuneal*, *funereal*, *lacteal*, *lineal*, *subterranean*, and *venereal*?

G. WASHINGTON MOON.

December 20th, 1873.

# NOTE ON A PROBABLE NOTICE OF AN AURORA BY JOSEPHUS AND TACITUS.

## ACCOUNT OF JOSEPHUS.

"Prior to the revolt and the first movements of the war. . . . On the 21st of the month Artemisius . . . Before sunset were seen around the whole country chariots poised in the air, and armed battalions speeding through the clouds, and investing the cities."<sup>a</sup>

## ACCOUNT OF TACITUS.

"Visce per cœlum concurrere acies, rutilantia arma, et subito nubium igne collucere templum."<sup>b</sup>

These accounts employ so exactly the language used by early historians of the aurora, that it seems worth while to examine how far the probabilities of the case agree with their being due to an appearance of this meteor.

"Before sunset" is rather a loose definition of the time, and probably merely indicates when attention was first drawn to the aurora; the full beauty of which, according to all experience, would occur later. In any case, it points unquestionably to a very grand display, as an aurora has only in few instances been seen in daylight, and I am not aware of another instance in so low a latitude.

"It is recorded to have been seen at London, C.W., on the 24th of July, 1848, at half-past 7 p.m., which is but a few minutes after sunset."<sup>c</sup>

Here we have one of the few recorded appearances in daylight, observed in July, one of the two months in which the aurora is but little seen.

The aurora of February 4th, 1872, is mentioned in Tristram's "Land of Moab," as having been seen there but little inferior in splendour to more northern latitudes.<sup>d</sup>

An aurora, bright, very extensive, and red in colour, might be expected to be seen in the time of year, and solar spot period most favourable for such displays. Neither agrees with the probable date of the meteor in question. The revolt broke out in August, A.D. 66,<sup>e</sup> and the 21st of Artemisius must fall on May 5th in that year. 66 is too soon after the previous spot minimum year, as "the progression from minimum to maximum is more rapid than from maximum to minimum,"<sup>f</sup> and June being the month of least frequency of auroras, May 5th becomes rather a late date.

Mairan mentions, under the date of January 28, 807 or 808, "Autres armées qui paroissent au ciel pendant la nuit, et d'une grandeur extrême." A transit of Mercury is recorded in the same year, and for this Kepler gives the date 808.<sup>g</sup> 809 was a spot minimum year. It will be remembered that the years about the last spot minimum, 1864 to 1866, were not without fine appearances of the aurora.

<sup>a</sup> Josephus, Traill, vol. II., fol. 197.

<sup>b</sup> l. Tacit: Hist: lib. V., cap. xiii., quoted in Keith's "Evidence of Prophecy," fol. 59, note.

<sup>c</sup> Phil. Mag., vol. XXXVI, new and united series, fol. 461. <sup>d</sup> Fol. 34.

<sup>e</sup> Josephus, Traill, vol II., fol. 171. <sup>f</sup> See "The Sun," Proctor, fol. 198.

<sup>g</sup> Mairan, fol. 190.

On the whole, I think we may have described in the accounts an aurora of remarkable extent and brightness; it does not seem possible in the present state of our information to carry the proof further.

W. D. HOWARD.

## OBSERVATIONS ON THE WEATHER AT CAMBRIDGE IN 1871, 1872, AND 1873.

	1871.	1872.	1873.
Mean temp. ....	47°1 ...	49°0 ...	47°5
Hottest by Day .....	Aug. 13	July 25	July 22, 23
	83° ...	84° ...	81°
Coldest by Night.....	Dec. 19	Mar. 21	Dec. 12
	16° ...	25° ...	21°
Days on which the max. was at or under 32° .....	10 ...	0 ...	4
Nights on which the min. was at or under 32° ... ..	81 ...	35 ...	72
Mean of bar. ....	29·8 ...	29·6 ...	29·8
Bar. highest .....	Mar. 2	April 7	Feb. 19
	30·2 ...	30·3 ...	30·4
Bar. lowest .....	Jan. 17	Jan. 24	Jan. 20
	28·6 ...	28·2 ...	28·2
	Inches.	Inches.	Inches.
Rainfall .....	19·20 ...	27·84 ...	21·30

[We reprint this in fac-simile as a good type of condensation of nearly all the important elements in a remarkably small space.]

J. NUTTER.

## PHENOMENA OF GREAT STORMS.

BY PROF. ELIAS LOOMIS.

[As indicative of the energetic way in which Meteorology is being prosecuted in the United States, we reprint with pleasure the two following articles, which appeared in the *New York Journal of the Telegraph*, for December 1st, 1873.]

This paper was described by title as "Some Results Derived from Examination of the United States Weather Maps."

The remarks I propose to make consist rather of a statement of what I am engaged in doing than of results which I am prepared to communicate. It is known to some persons that many years ago I undertook the investigation of certain storms, particularly Winter storms. Some 30 years ago I published in the transactions of the Philosophical Society of Philadelphia, my investigations of a remarkable storm which was experienced throughout the United States in December, 1836. This storm of December, 1836, was followed a few days after by a remarkable storm in New York, and many conjectured at that time that there was a connection between the two storms; and that the American storm crossed the Atlantic. Some years after, in 1856, I spent some time in Europe, and improved the opportunity to collect observations relating to this storm. I collected copies of meteorological journals for that period, and on my return undertook a new investigation of the phenomena of that storm, and of the American storm that preceded it. I have received maps regularly from the Department for about two years, and have preserved them carefully. I have thought it worth while, however, to undertake myself a systematic examination of these maps.

I first prepared a skeleton map upon precisely the same scale as the Washington maps, confining myself, however, to that portion of the country over which these storm tracks usually pass. Although these weather maps extend to the Pacific, the Department has never drawn isobaric lines extending beyond the Rocky Mountains with one exception, so that I was compelled to reduce the dimensions of my skeleton map, though retaining precisely the same scale. The first step consisted in transferring the tracks of all these barometric minima to this map.

The next step consisted in tabulating all these results. The lines on the maps are measured, and the dates and movements recorded in tables for two years. The direction of the storm track, and its motion per day, is indicated so that the tables show the progress in 24 hours of the barometric minima and their direction. He had complete tables for these months for two years. These tables, together, would show the average rate of progress of barometric minima and average direction. The average rate of progress each day for January was 680 miles; for February, 740 miles; for March, 940 miles; for April, 615 miles. The average for these four months was little less than 700 miles—a trifle less than 30 miles an hour. For the month of January the average direction of progress is 5 degrees north of east; that is the direction toward which the storm travels. It is very rare indeed that a storm travels toward the west, though we had one of that sort during the last week. There are only one or two decided cases of that kind in the period of two years. They almost invariably travel toward the east and a little north of east. For February the average is about 13 degrees north of east; for March, 11 degrees north of east; for April, 16 degrees north of east.

The object which I propose in this research will be to investigate the various circumstances which seem to cause these movements, the rate and the direction; to determine what other meteorological elements are connected with these. I tabulate with these numbers, therefore, a good many other points. One is a tabulation of what they call the "low," which means simply the lowest barometrical indication on the weather maps. Another is the fall in 24 hours—the fall of the barometer in that place where there is a "low." This is easily ascertained by consulting the map of the previous day at that place. The rise in the next 24 hours at the same place is found in the same way. Another element tabulated is the change of the "low." One day a "low" will be 29.4 in.; the next day it will be found some 500 miles east and perhaps will be 29.5 in. or 29.3 in. It will not be generally stationary from one day to another. In other words, the storm will be increasing or diminishing in violence.

There is one point in regard to which he could make a somewhat precise statement. It is what may be called the stationary "low;" that is a stationary storm. In general, these storms travel with considerable velocity; occasionally we find examples of storms stationary for 24 hours, sometimes two or three days; there are examples of very violent storms remaining stationary for four days. The European storm of 1836 was the memorable storm of the century in its violence, which extended through Great Britain and all over the continent. At that time there was formed a "low" almost exactly over Switzerland, which continued stationary for four days, and the isobaric curves at that time were quite symmetrical and nearly circular, though slightly elliptical. The depression of the barometer at the centre of the storm was from a half to three-quarters of an inch below the average minimum.

Similar phenomena have been noticed since then in many instances in Europe. The localities where they have been most frequently observed are off the Irish coast, or somewhere along the coast line from the north of Scotland, following down the English and French coasts to that of Spain. An average of notable cases of that sort were collated to the number of six or seven per annum, where the barometer sank very low and continued long at the same depression.

In examining the United States maps he had been struck with the circumstance that a storm travelling across the United States to Maine and New Brunswick would stop there, and the "low" be marked there for two or three successive days. There was no evidence whether the "low" proceeded beyond that point, as the map cannot give further information. However, by comparing these observations carefully, it will be found that the actual height of the barometer at these most

easterly stations continues the same during two or three successive days. Professor Loomis attributes this phenomenon to local causes. These are probably the characteristics of the surface of the country—the high ranges of mountains which force the currents of air upward, and cause condensation of moisture. In the case of Switzerland, this is occasioned by the Alps; in our country it is the high lands of Maine, and the White and Green Mountain ranges. When there is a barometric minimum in that region, the air on the south side comes in from the ocean, and will be drawn in from considerable distances, probably from over the warm waters of the Gulf Stream.

REMARKS BY PROF. HENRY.

Prof. Henry suggested that if the storm comes to the seaboard the air is constantly drawn in from sea, bringing an immense amount of vapour. This may continue several days, constituting at Boston, for instance, a long and violent north-east storm, when 50 or 75 miles back in the country the air is clear. The storm appears to be produced by the heating of the lower strata and their expansion; then the equilibrium being disturbed there is a rushing up of the moist air into a higher region, where it is condensed, and the caloric given out, whereby the effect is increased. The whole storm is wafted eastward till it comes to the seaboard, where it obtains a continued supply. In the interior the supply at a given point is soon exhausted, and this may be a cause of the storm moving eastward. During a storm at the seaboard there is a motion outward; the wind is blowing inward from the ocean below, but outward toward it above.

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## THE SIGNAL SERVICE—UNITED STATES.

The connection of the Signal Service with the lines of telegraph throughout the country renders its operations more or less important to all engaged in telegraphic service. The annual report of the Chief Signal Officer has just been published, from which we glean as follows:—

Systematic and continuous instruction of the army in military signalling and telegraphy during the past year, has been given at the Signal School of Instruction at Fort Whipple, Va., and in the Department of the Missouri. The recommendation made in previous reports, that special instruction at the Military Academy should be provided for, with a merit value given it, affecting the standing of the cadets, is renewed, and it is also suggested that to secure accuracy and uniformity, the officer to be in future charged with that instruction should have passed through the course at Fort Whipple.

Six commissioned officers have received instruction at Fort Whipple during the year. Sixty-seven private soldiers have been instructed as candidates for promotion to the grade of observer-sergeant, and 127 as assistants to observer-sergeants.

The whole number of stations from which the office now receives its stated meteoric reports is 92, of which 78 are the regular stations in the United States; 11 are in Canada; three in the West Indies. Of the stations in the United States, 13 have been added during the year; and of the Canadian, from which reports have been received by comity of exchange with the Dominion Meteorological Bureau, four are new. The regular telegraphic reports from Havana, Cuba, began on August 6; from Kingston, Jamaica, on September 18, and from Santiago de Cuba on September 29. Three other points in the islands of Porto Rico, Gaudaloupe, and Barbadoes, will be equipped as soon as observers can be designated.

The total number of tabulated bulletins issued and distributed at the several lake, seacoast, and river ports and inland cities has been 143,097, excluding the river bulletins of changes in depth of water of principal rivers. The total number of weather charts issued and distributed has been 320,770, and the press reports (exclusive of the publication of the synopsis and probabilities) have been 23,224. Nine thousand four hundred and two copies of "the weekly weather chronicle" and 6,896 of the "monthly weather review" have been furnished and gratuitously distributed to the press, agricultural and commercial associations, institutions of learning and scientific persons.

The office has, under the direction of the Secretary of War, continued its exertions to solve, for the special benefit of the agricultural interests, the problem of giving promptly the information contained in the daily weather reports to the many farming and other communities not now reached by telegraph, and for which the copies published by the press do not arrive in time for use. The plan adopted has been to divide the territory of the United States into districts, each district having a distributing point at or near the centre, from which two printed copies of the Synopses and Probabilities are forwarded by mail to all post-offices within the districts, and which can be reached by rail, steamer, or mail coach by 4 p.m. of the same day. This plan has been put in operation with the co-operation of the Post-office Department, the bulletins being exhibited in frames by each postmaster at each post-office as soon as received, and now provides for the regular distribution daily of 8,982 copies of the Weather Report, for display at 4,191 different post-offices.

For the study of the phenomena of the upper portions of the atmosphere, in view of the benefit of the deductions to be had from them, and to determine more accurately the proper reductions to be made for great elevations, stations have been established at favorable points. In addition to those on Mount Washington, N. H., and on Mount Mitchell, N. C., the difficult task of establishing a permanent telegraph station on the summit of Pike's Peak, at an elevation of 14,216 feet, has been accomplished with the sanction of the Secretary of War. A telegraph line has been built to connect the station with Colorado Springs, and it is now in operation.

The ascertained comparative accuracy of the deductions from reports, styled "Probabilities," has been more clearly presented in this than in preceding years. The percentage of verification has been mathematically computed for each of the geographical districts mentioned in the reports. The annual average of verifications has been as follows for the following named districts:

New England, 81.50; Middle States, 81.17; South Atlantic, 79.92; Lower Lakes, 78.90; Eastern Gulf, 77.16; Ohio Valley, 76.42; Western Gulf, 74.40; Upper Lakes, 75.25; North West, 74.00.

An additional duty was imposed upon the Secretary of War by the legislation of the last Congress, authorizing the establishment of signal stations at lighthouses and at such of the life-saving stations on the lake or sea coasts as may be suitably located for that purpose, and to connect the same with such points as may be necessary for the proper discharge of the duties of the Signal Service by means of a suitable telegraph line, in cases where no lines are in operation. In discharge of this duty, a telegraph line has been completed, ten miles in length, from Seaville to Peck's Beach, N. J., connecting at Seaville with the line of the Western Union Telegraph Company. The material is ready, and the work is in progress on the construction of a line from Sandy Hook to Barnegat Inlet, N. J., a distance of 50 miles, connecting with the Western Union line at Long Branch. These connections will allow of signals being displayed at the life-saving stations established at Sandy Hook, Long Branch, Barnegat, Atlantic City, Peck's Beach and Cape May. The plan in contemplation proposes the establishment of signal-stations at life-saving stations and lighthouses along the ocean coast of New Jersey, from Sandy Hook to Cape May, at distances of 25 miles from each other. A line is in process of erection from the village of Rockport, Mass., to Thatcher's Island Lighthouse, a distance of three miles and a half, of which one mile and a half will be cable. A line connecting the stations at life-saving stations and lighthouses along the coast, from Norfolk, Virginia, to Cape Hatteras, North Carolina, a distance of 137 miles, and on one of the most dangerous coasts of the United States, is in construction. It is expected that the above-mentioned lines will be completed during the present year. Attention is invited to the fact that the whole work now done in the erection of these lines, and to be done hereafter in operating them, has been done, and is to be done, by the officers and men of the Signal Service of the army.

The Chief Signal Officer refers to the proceedings of the Meteorological Congress of Vienna, held in pursuance of invitations officially issued by the Austrian Government, for a convention of persons charged with meteorological duties in

different countries. The adoption, by the unanimous vote of the Congress, of a proposition to the effect that it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suitable for the preparation of synoptic charts, should be taken and recorded daily and simultaneously at as many stations as practicable throughout the world, is regarded as of special importance in reference to works of the kind now undertaken by the United States. This formal announcement, with such sanction, tends directly to the establishment of systems of signals and weather reports common among civilized nations.

Arrangements have already been made with Russia and Turkey to begin, on January 1, 1874, the exchange with the United States of one daily report, taken simultaneously at the different stations throughout the great territorial extent of the Russian and Turkish Empires and the United States. The co-operation of the systems of other nations is expected.

## REVIEWS.

*Report of the Director of the New York Meteorological Observatory for 1872.* New York: W. C. Bryant and Co. 1873. Large 8vo.

IN addition to giving in extenso the daily observations made at 7 a.m., 2 p.m., and 9 p.m., this report is devoted to three subjects—

(1.) Has the summer temperature of the Atlantic States undergone any modification?

(2.) What is the direction in which atmospheric fluctuations cross the United States?

(3.) Is it possible to trace the passage of American storms across the Atlantic, and predict the time of their arrival on the European coast?

It appears that in previous reports Mr. Draper has been discussing the question of modification in the climate of the Atlantic States with the following result—(1.) Taking the rainfall in successive periods of ten years each, he found that there had neither been an increase nor decrease. (2.) He found that the number of days the Hudson river remained closed, taken in periods of ten years from 1817 to 1866, always averaged 91. And (3.) That the records of New York, Philadelphia, Boston, and Charleston, for the winter months did not support the idea of any alteration in their average temperature. In the present report it is shown that there has been no decided change in the summer months.

In the course of the present inquiry the disturbing influence of the very cold year of 1836 was of course speedily noticed, and a set of diagrams showing its relative intensity in various parts of the States, and for contrast one diagram from St. Petersburg was given in the work before us, together with the following comment:—

“The period to which the year 1836 belongs is well worthy of attention. In some respects it seems to be an exception to the general uniformity, as appears from synoptic chart of the mean annual temperature, Plate 1. The mean annual temperature of New York began to decline in 1830, and continued so to do for two years; then it remained stationary for two years more, and then for two years—that is to say, to 1836—it fell again. Thus far it had fallen 7.2 degrees. It then commenced to rise, returning in the same manner that it had fallen, but only 5.8 degrees. In New York the fall had been from 54.8 to 47.6 degrees; the rise was from 47.6 to 53.4 degrees. This remarkable variation extended from Boston to New Orleans, along the Atlantic and Gulf coasts, but it did not occur in the interior of the continent, as at Fort Snelling, near St. Paul. In Plate 1, I have given



the curves for several American cities, and also for St. Petersburg, in Russia. I have introduced that of the last-named city, in which we do not detect this variation, because it seems to me to have much significance in the interpretation that should be given of the event. Variations such as this can be due only to one of two causes, astronomical or terrestrial. If the sun's light decline in brilliancy, there must be a decline in the mean temperature; if it increases, there must be an increase. Some persons might be disposed to refer the variation under consideration to that astronomical cause; but if such were the case the temperature should simultaneously change in all localities on the face of the earth. We should detect decline in St. Petersburg, and at Fort Snelling as clearly as in the Atlantic cities, or in those of the Gulf. Hence I infer that the cause in question was not of an astronomical nature, but of a local and temporary kind."

We should be glad to see this subject discussed more fully than it is in the present report. It is the salient feature in American records of temperature, and well worthy of thorough investigation. Moreover, in spite of Mr. Draper's quotation from St. Petersburg, we think it probable that some important light may be thrown upon the subject by a fuller discussion of European records. We are by no means sure that the five consecutive cool years at Greenwich (1836-40) were uninfluenced by the excessive coldness of the United States.

The second is the least able portion of this report. The Director has devoted several pages and charts to a discussion (based upon the signal-office maps) of the direction in which atmospheric fluctuations cross the United States; but it does not appear to us that he throws any new light upon the subject, and he finally sums up in the following words:—

"Then the general conclusion to be drawn from these tables and maps is, that these atmospheric disturbances cross the United States in a direction towards the east."

The third section of this report is brief, and so remarkable that we reprint it verbatim, omitting only the tables which occupy four pages, and of which doubtless any one willing to prosecute the subject could readily obtain a copy.

"If these meteorological waves cross the United States, why should they not also continue their course and cross the Atlantic ocean? With a view of answering this inquiry, I have collated the registers produced by the instruments at this Observatory with those obtained at Valencia and Falmouth, as given in the *Quarterly Weather Report*, published by the Meteorological Office of Great Britain, the distance under consideration being about 3,100 miles. From this it appears that there are many atmospheric waves which do cross the Atlantic, and that the time of their passage may, within certain limits, be predicted. If, in the case of an easterly wind which is travelling about 200 miles in twenty-four hours, we find the exact time of the lowest reading of the barometer, and ascertain its speed for 24 hours before, and 24 hours after that time, the mean of these two numbers will give the rate of the storm in 24 hours. If 4,200 be divided by this last number, the quotient will express the number of days required by the storm to cross from New York to Falmouth or Valencia.

If the above statement can be shown to hold good in the case of storms for two or three years, the result would be of great value to home and foreign commerce. It would indicate whether ship captains about to leave port might be delayed by approaching foul weather, whether they could get well out to sea before its occurrence, in what part of the ocean they might expect to encounter it, and what would be its duration.

As an explanation of the following tables, I will take the first example that they offer:

On the 4th of October, 1869, there occurred a low barometer (at this Observatory) at 1 p.m. In 24 hours previously the wind had made 313 miles, in the 24 subsequently it made 286 miles, the mean of these numbers being 299. This, divided into 4,200, gives the time of passage across the Atlantic, 14 days, and the date of its arrival at Falmouth, October 18th. The actual time of its arrival, as shown in the English Weather Reports, was on that day.

The table for 1869 commences in October, this being the month in which the self-recording instruments of this observatory were sufficiently advanced to furnish reliable registers. For the year 1870, we have a complete set of observations, both from our own and the English instruments. For the years 1871-2 I have compared our results with those of the quarterly weather reports from England, as far as I have received them.

It will be noticed in the tables that sometimes storms leaving this side of the Atlantic several days apart, arrive in the British Islands on the same day. When this is the case, the storm there is generally a very severe one. There are also instances in which the last storm overpasses the first by several days. It will also be observed that there are variations in the track of these atmospheric disturbances depending on the course they are pursuing when they leave the American coast, and this will determine the point at which they will be most severely felt on reaching Europe.

We are therefore brought by the foregoing discussion to this interesting conclusion that out of 86 atmospheric disturbances expected to cross the Atlantic, only 3 seem to have failed."

Considering (1) that there is no mention of the separation of motion of revolution from velocity of progression, (2) the wide difference in the motion after existing between "twenty-four hours before" and "twenty-four hours after," *e.g.* Jan. 4, 1872, 252 miles and 152 miles, and (3) that the direction of motion can surely hardly be uniform, we are much surprised at the frequent accuracy of agreement. To a great extent the system inaugurated by General Myers will test the reliance to be placed on this method; but it would be still better if the Atlantic Telegraph Company would grant the same privilege to meteorologists as they have done to astronomers, and allow Mr. Draper to send free of cost four words about three times in each month. All that would be required would be "Storm due February 8." Six months' trial would be worth years of post-facto compilations.

Judging by the terse and vigorous tone of the report no one would be more ready to accept this proposal than the able director of the New York Meteorological Observatory.

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*General Remarks on the Climate of Bombay.* By C. CHAMBERS, F.R.S., Superintendent of the Kolaba Observatory. [Appendix to Report of Bombay Harbour Board.] 39 pages, 8vo.

THIS pamphlet opens with a statement which, though a truism, is by no means so widely acted upon as it ought to be—

"To acquire distinct notions of the general nature and peculiarities of a particular season or year, it is necessary that a definite standard of comparison should be present to the mind, and it is convenient if practicable that the normal climatic conditions of the place should constitute that standard."

Acting up to this excellent rule, Mr. Chambers proceeds to state the position of the Kolaba observatory with respect to the native part of

Bombay. He then proceeds to point out that the special feature of Bombay weather is the marked division of each year into two seasons, the wet and the dry, the former beginning about June 5th and lasting about four months, the period in fact of the south-west monsoon, the commencement and close of which is generally marked by frequent and violent thunderstorms—while during it (in spite of about one day in five being rainless) nearly seventy inches of rain fall.\* The greatest fall on record in a short time is 4·22 in., between 3 and 4 p.m., on June 12, 1847.

The temperature of the air is very equable, the mean for the coldest month, (January  $73^{\circ}8$ ) and for the hottest (May  $83^{\circ}9$ ) only differing by  $10^{\circ}1$ , or less than the daily range during the winter months, which is at that period about  $12^{\circ}$ . The mean temp. of the year is  $79^{\circ}0$ .

The normal direction of the wind is W.N.W. with a velocity of  $6\frac{1}{2}$  miles per hour.

The year 1871 was principally remarkable for slight rainfall (40·58 in.), less in fact than any year on record, the nearest approach being 41·18 in. in 1855, while the average as above stated exceeds 70 inches, and in 1849 114·89 in. fell. Two other stations, viz., Bombay Fort and Byculla, being nearer to some low hills, had the larger yearly totals of 42·76 in. and 47·20 in. respectively.

The mean temperature  $80^{\circ}1$  was  $1^{\circ}1$  above the average, but the highest was only  $93^{\circ}3$ ; the minimum was  $66^{\circ}1$ .

In concluding this brief notice of a report which well repays careful reading, we venture to express the hope that in a future one Mr. Chambers will give us an abstract of some of the principal elements upon which his normal values are based, *e.g.*, he gives the average mean annual temperature as  $79^{\circ}0$ , elsewhere he shows that in 1871 this was exceeded by  $1^{\circ}1$ , but there is nothing to indicate the ordinary fluctuation of this element, or to show whether  $1^{\circ}1$  was or was not a remarkable excess. Nor is there any information as to the position of the instruments; possibly this has been given in a previous report, but if so a reference to it would have been acceptable.

## THE WINTER.

*To the Editor of the Meteorological Magazine.*

SIR,—The tardy appearance of snow this morning reminds me how very mild a winter we have had hitherto. Certainly the inhabitants of this part of the country would have little to complain of, if all winters were as mild, dry and fine, as this has so far been. We have had very little rain;  $2\frac{1}{2}$  inches in November, and only an inch in December, with nine days' rain, and for days together the roads were as dry as if it were summer. There has been absolutely no fog, and

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\* The average amounts are June, July, August, and September 67·37, October 2·29, and during the remaining seven months, November to May inclusive, only 1·15, total 70·81 in. Mr. Chambers gives 70·82, but either that is a misprint, or there is a slight error in his table.

at the time when it was so thick in London and all other low-lying parts of England, we enjoyed clear, bright and cloudless weather, with only one night of hard frost (min.  $22^{\circ}6$ ). It has been windy at times certainly; the gale of December 16th was next-door to a hurricane, and quite as bad as the gale of October 19th, 1869, at Whitby. I estimated the force of the squalls at 11 on Beaufort's scale, and I see that Mr. L. J. Crossley reports that the pressure several times exceeded 50 lbs. at Halifax, the recording-pencil going off the paper. A stone cross was blown off Aysgarth Church, with a massive stone to which it was attached, and innumerable slates were blown off buildings, and here and there a good many trees blown down. Three other gales about equalled in force the gale which visited the south of England on December 8th, 1872, viz., those on November 29th, December 21st, and January 1st, the force being 9 or 10. During the great storm of the 16th the barometer was steadily rising, the wind being most violent from 9 to 11 a.m., and the direction W.S.W. to W. In none of these gales have I observed any rapid movement of the barometer, the progression of the storms being, I suppose, nearly along the isobars, and not across them, as in gales from S.S.E. and S. I will not encumber your columns, therefore, with barometrical readings, but will gladly send them to anyone who wishes to work out the gradients, &c.

I will only observe further, how uniform, on the whole, the temperature of the last quarter has been. Thus—

	<i>Means of Temperature.</i>						<i>Extremes.</i>	
	9 a.m.	9 p.m.	Max.	Min.	9 a.m. & 9 p.m.	Max. & Min.	Mean temp.	Max. Min.
October	44.8	43.5	52.5	37.0	44.15	44.75	44.45	66 24.0
November	41.4	40.5	46.5	37.1	40.95	41.80	41.37	55 24.6
December	41.3	42.1	46.4	37.1	41.70	41.75	41.72	54 22.6

What will Mr. Brumham say this evenness prognosticates? I rather believe in his predictions, in spite of the temperature having been  $1^{\circ}5$  above the average last summer, instead of, I forget how much below. But I should like to know the grounds for his predictions—if they are of a nature that we can comprehend.

I am, Sir, your obedient servant,

F. W. STOW.

*Aysgarth, Bedale, January 3rd.*

# DECEMBER, 1873.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 1/10 or more fell.	TEMPERATURE.						No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.							
				Dpth	Date.										
										Deg.	Date.	Deg.	Date.		
		inches	inches.	in.				Deg.	Date.	Deg.	Date.	In shade	On grass		
I.	Camden Town .....	.48	— 1.02	.17	26	8	56.7	17	22.9	11	6	11			
II.	Maidstone (Linton Park).....	.46	— 1.37	.19	31	7	57.0	17	21.0	29	10				
	Selborne (The Wakes).....	.56	— 2.19	.26	30	9	54.2	16	16.0	10	12	17			
III.	Hitchen .....	.60	— .71	.24	26	9	50.0	2, 18	20.0	11§	13				
	Banbury .....	.80	— .87	.24	19	9	56.0	16	16.5	10§	12				
IV.	Bury St. Edmunds (Culford).....	.69	— .80	.20	25	8	55.0	16	20.0	11§	10	15			
V.	Bridport .....	1.34	— 3.03	.20	30	5	56.0	11	21.0	11	8				
"	Barnstaple.....	1.45	— 1.67	.24	19	18	53.5	19	26.0	10					
"	Bodmin .....	1.32	— 3.92	.37	30	17	53.0	16	29.0	12	4	7			
VI.	Cirencester .....	.97	— 1.32	.29	25	9	...	...	...	...	...				
"	Shiffnal (Haughton Hall) ...	.85	— .83	.23	30	10	55.0	16	16.5	13	10	14			
"	Tenbury (Orleton) .....	.62	— 1.84	.25	26	9	58.0	16	15.5	13	15	16			
VII.	Leicester (Wigston) .....	.49	— 1.03	.15	26	8	57.0	16	22.0	11	10				
"	Boston .....	.32	— 1.17	.08	19*	6	53.0	17	25.0	12	7				
"	Grimsby (Killingholme) .....	.27	...	.10	26	9	57.0	16	25.0	13	7				
"	Derby.....	.26	— 1.29	.08	23	7	56.0	16	21.0	13	9				
VIII.	Manchester .....	.78	— 1.55	.17	22	10	59.0	16	22.0	12	9	13			
IX.	York .....	.38	— 1.42	.10	26	7	55.0	9	20.0	13	9				
X.	Skipton (Arncliffe) .....	3.57	— .98	.67	30	22	52.0	15	20.0	11	12				
"	North Shields .....	.29	— 1.91	.12	26	10	55.0	5†	27.5	29	6	12			
"	Borrowdale (Seathwaite).....	11.74	— 5.21	1.80	30	24	...	...	...	...	...				
XI.	Cardiff (Ely) .....	1.08	— 1.52	.30	30	9	...	...	...	...	...				
"	Haverfordwest .....	1.66	— 3.17	.33	30	18	53.0	1	21.5	10	6	11			
"	Rhayader (Cefnfaes).....	1.24	— 2.05	.20	3, 29	15	53.0	...	19.0	...	...				
"	Llandudno.....	1.44	— .76	.64	19	12	55.4	17	30.0	12	2				
XII.	Dumfries .....	1.35	— 2.11	.32	15	19	56.0	15	23.0	28	6	11			
"	Hawick (Silverbut Hall).....	1.48	...	.28	21	14	...	...	...	...	...				
XIV.	Kilmarnock (Annanhill).....	2.18	...	.36	30	19	53.0	16	25.5	28	6	8			
XV.	Castle Toward .....	3.33	— 2.02	.45	21	20	53.0	3	...	...	6				
XVI.	Leven (Nookton) .....	1.56	— 1.22	.42	5	13	55.0	16	24.0	12	11	20			
"	Stirling (Deanston) .....	3.69	— .50	1.11	17	20	53.0	16	23.9	27	8	10			
"	Logierait .....	2.69	...	.41	23	17	55.0	1	25.0	6, 27	13				
XVII.	Braemar .....	3.16	— .61	.80	23	18	50.8	13	20.1	28	9	13			
"	Aberdeen .....	1.91	...	.66	23	13	57.2	16	28.2	28	5	20			
XVIII.	Inverness (Culloden) .....	2.51	+ .50	.54	25	17	54.3	15	30.2	28	1	11			
"	Portree .....	13.14	— 2.49	1.70	7	30	...	...	...	...	...				
"	Loch Broom .....	8.16	...	.76	19	29	...	...	...	...	...				
XIX.	Helmsdale .....	3.49	...	.58	15	23	...	...	...	...	...				
"	Sandwick .....	4.29	+ .32	.96	12	22	53.0	16	31.6	28	1	6			
XX.	Caherciveen Darrynane Abbey	1.86	...	.39	30	21	...	...	...	...	...				
"	Cork .....	.77	...	.30	30	20	...	...	...	...	...				
"	Waterford .....	1.16	— 3.26	.29	31	15	57.0	15†	28.0	28	3				
"	Killaloe .....	2.52	— .97	.55	30	19	55.0	15	25.0	28	5	7			
XXI.	Portarlinton .....	1.09	— 2.10	.28	19	22	57.0	16	26.5	27	5				
"	Monkstown, Dublin .....	.71	— 1.91	.14	18	9	54.0	2	22.0	11§	7				
XXII.	Galway .....	1.84	...	.27	15	19	55.0	2	27.0	28	3				
"	Bunninadden (Doo Castle) ...	1.63	...	...	...	...	...	...	...	...	...				
XXIII.	Waringstown .....	.78	...	.21	28	12	57.0	15	25.0	27	10	15			
"	Edenfell (Omagh).....	1.55	...	.35	21	20	53.0	15	25.0	27	9				

\* And 27. + 17 & 23. † 16. § 12. || 13.  
 + 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.**—The driest and finest December I have on record for twenty years, that of 1857 being the nearest approach to it; Bar. high the greater part of the month, especially the first fourteen days, during which no measurable rain fell. Fogs frequent. Frosts, not severe, in second and last week. Winds (never high) veered from S. to W. and N., being only one day E. Altogether a remarkably fine month.

**SELBORNE.**—Fog nearly every day till the 20th. No snow. Prevailing winds the last half of month W.; Bar. remarkably high during the first fortnight, 30·46. Very mild on the 2nd, the min. ther. was 45°.

**BANBURY.**—On the 10th dense fog in the evening, 11th dense dry fog from 9.30 a.m. to 10 p.m., and on the 12th the same kind of fog from 8.30 p.m. to 10 p.m. On the 10th the fog only occupied the low ground, not extending to the higher ground, immediately S. of the town. I do not recollect any other noticeable instance of dry fog in these parts such as occurred on the 10th, 11th, and 12th, nor indeed any fog so dense, or of so long continuance. People who had lived in Banbury for years lost their way in the narrow streets; and many farmers and others attending Banbury market on the 11th had to leave their conveyances and walk home to the neighbouring villages, or to lead their horses all the way home.

**CULFORD.**—The weather during the month has been mild and fine for the season, with a preponderance of Westerly winds, being 27 to 4 of an Easterly direction. Average temperature of the month, 39°·2.

**BODMIN.**—This month has been remarkable for its excessive mildness and the absence of high wind, but more especially so for its small rainfall, being nearly four inches below the average of twenty-four years. Mean temperature of month 45°·8.

**HAUGHTON HALL, SHIFNALL.**—With the exception of one week, viz., from 10th to 15th inclusive, the month was remarkably mild and dry up to the 27th, till which day the rainfall was only ·12. On the day above mentioned († the 10th) frost set in suddenly and strong, the thermometer sinking at night to 23°, 18°, 17°, 16°, 20°, and 32°, on the six nights respectively, accompanied by fog with a most beautiful rime on the trees and herbage, and a very high Bar. Ice 1½ in. thick. On the 27th, after heavy rain at night, fog with rime set in again, though less severe, continuing to the close. Christmas-day was very mild. Vast quantities of holly berries. The wind throughout varied from N. to W. and S.W.

**ORLETON.**—The driest December for many years, but in 1846, only ·64 was registered. Bar. remarkably high and steady for the first half of the month. The temperature very variable, but rather below the average of the month. On the 9th severe frost set in and continued till the 15th with dense fogs and great rime in the valleys. Although many of the days were bright and sunny the rime remained on the trees from the morning of the 10th till the night of the 14th. On the 13th and 14th the river Teme was frozen over in many places. On the 16th a violent wind occurred. Bar. 30·41 on the 12th, min. temp. 15°·5 on the 13th.

**WIGSTON.**—With the exception of the very strong wind which passed over the midland and north midland counties on the 16th the month has been characterized by an unusual quietness in the atmosphere. Foggy weather has been experienced. A very small rain fall, less than half an inch during the month. The total fall during 1873 has been three inches below the average in this locality.

**BOSTON.**—December one of the driest ever known, the nearest being in 1857. Water is so scarce in the country that water-carts are in frequent requisition to fetch water for domestic purposes and for stock; this presents a great contrast to last year, when the fen-engines were working night and day to keep the water down, and nearly every part of the country was flooded.

**GRIMSBY.**—The driest month since I have kept a register (eight years). Many

pleasant days ; several rose trees have been in flower. The springs are very low. Stormy, with high temperature on the 16th.

DERBY.—December has been meteorologically a very remarkable month, the prevailing direction of the wind being W. and S.W., notwithstanding which the Bar. has been excessively high, and the rainfall less in quantity and fewer days on which it fell than has been registered in Derby for the last thirty years.

SEATHWAITE.—Rainfall 5 inches below the average, S on mountains on 22nd.

# W A L E S.

HAVERFORDWEST.—I find, on reference, that no December during the last twenty-four years has produced such a small rainfall as this, 1857 comes the nearest, 1·88 in. The weather at the commencement was densely foggy and almost constant drizzling mist with extraordinarily high bar., this was succeeded by a week of very sharp frost and some low readings of the ther., the remainder of the month constantly rainy, damp, and mild. Heavy gale from the E. on the 29th. Stormy and cold at the end.

CEFNFAES.—The month has been mild and pleasant. Wind generally N.W. or S.W. Primroses and many other flowers in blossom.

LLANDUDNO.—A fine month. No fog, and only on two nights did the temperature fall below 32°, and then but slightly, the lowest being 30° on the 12th.

# S C O T L A N D.

DUMFRIES.—The first week showery but mild, the second dry with occasional frost and fog, the latter half of the month showery with strong gales on several nights, and the last week three frosty nights followed by stormy weather. On the whole fine and mild for the season, the rainfall considerably below the average ; the temp. 3°·6 above that of Dec. 1872. Vegetation unusually forward, snowdrops one inch and a half above the ground, the whin or furze in bloom.

SILVERBUT HALL, HAWICK.—Heavy gales on the 14th, 15th, 21st, 22nd, 23rd, 24th and 29th. Very little frost, and the month on the whole has been more like March (for mildness) than December.

ANNANHILL, KILMARNOCK.—Great storm on 15th and 16th, S.W. to W.N.W., began about 5·30 p.m. on the 15th and ceased about 11 a.m. on the 16th. Gales also on nights of 5th, 8th, 9th, 21st and 23rd ; velocity on the 16th, seventy-six miles an hour. Rainfall small, month generally cloudy. Aurora in the W. on the 19th. In the middle of the month yellow jasmin, clematis, and some spring flowers in bloom in the open air, some frost towards the end of the month, but not severe, the min. 25°·5 on the 28th. Small-pox and typhoid fever very bad, death rate in the parish during the month 43 per 1000.

NOOKTON.—On the 16th violent gale in the night and again on the 21st.

LOGIERAIT.—Several severe gales, especially on the nights of the 14th and 21st. Temperature on the whole above the average. Spring flowers appearing. No snow during the month.

BRAEMAR.—The most genial December ever known in these parts. Aurora and falling stars on the 7th. Lunar halos on 1st and 4th.

ABERDEEN.—A month of unusually dry and mild weather, but with frequent gales, that of the 16th being very heavy.

CULLODEN.—Storm on the 16th ; the anemometer between 9 a.m. on the 15th and 9 a.m. on the 16th showed a horizontal movement in the air of 559 miles and by 9 a.m. on the 17th an additional 384 miles, making the total horizontal, movement in the forty-eight hours 944 miles ; the greatest pressure on the square foot varied between thirty-one and thirty-six pounds ; the direction of the wind at the commencement of the storm was S.S.W. to S.W., but it gradually veered through W.S.W. and W. to W.N.W. on the morning of the 16th. This storm was very generally felt throughout Scotland and over the north of England, causing much damage to life and property. 30th a strong gale W.S.W.

PORTREE.—A very wet and squally month, a strong gale from S. all night on the 8th. A fearful hurricane from S. to W.S.W. from 7 p.m. on the 14th to 8 a.m. on the 15th ; loud thunder peal at 9 a.m. on the 14th ; TS from 5 to 7 a.m. on 31st. Snow, sleet and hail on the 23rd and four following days. Cattle and sheep healthy and thriving well on the pastures

**LOCHBROOM.**—This has been a most miserable month with only two dry days. The amount of rainfall (8.16) seldom exceeded in this district. Snow deep on the straths, and sometimes hard frosts were soon caused to disappear by another down-pour of rain, constant gales and an ample share in the hurricane that did so much damage over Britain.

**SANDWICK.**—December has had about the average quantity of rain, its temperature nearly  $3^{\circ}$  above the mean, and as usual in a warm winter it has been very stormy, the anemograph having traced more than 4,000 miles above the mean. A storm from 1 a.m. on 16th till 3 a.m. on 17th of 1380 miles in 26 hours, a mean of 53 miles, but 65 from 4 to 6 a.m. on 16th.

#### I R E L A N D.

**DARRYNANE ABBEY.**—The driest month since April 1872, and very mild but foggy. Wind W. and N.W. except 27th and 28th, when it was N.E. with fog.

**MONKSTOWN.**—There has been an unusual absence of R this month, although the atmosphere has been very damp, and the temperature high. Many trees (especially roses) budding, and thrushes, &c., singing.

**DOO CASTLE.**—Finest month of December on record. Very little R. till towards the close of the month. No frost.

**WARINGTOWN.**—The driest and finest December that I can remember.

**OMAGH.**—The weather of the month, especially up to the 20th, remarkably fine and mild. Fields green, primroses and daisies in some places in bloom, and altogether like spring.

### BIBLIOGRAPHY OF EVAPORATION.

*To the Editor of the Meteorological Magazine.*

SIR,—May I beg of you to give, in an early number of your Meteorological Magazine, the names of such books or pamphlets as discuss to some purpose the subject of evaporation from the surface of water, or such as furnish reliable facts thereanent—or direct me where to apply for them—and you will confer a favour on your obedient servant,

JAMES P. KIRKWOOD, C.E.

50, Pierrepont Street, Brooklyn, New York, Jan. 1st, 1874.

[We cheerfully give a small contribution towards supplying the very reasonable request of Mr. Kirkwood. The literature, however, is almost as meagre as the collection of trustworthy data. Most of the principal papers are referred to, or quoted, in articles upon the subject, in the annual issues of *British Rainfall* from 1867 to 1872. The following short list may, however, be a useful supplement.—ED.]

On suiting the depth of Drainage to the circumstances of the soil. Oct. 1849.

By J. H. Charnock. [*Journal of Royal Agricultural Society*, Vol. X., pp. 507—519.]

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On Evaporation and Evaporation Gauges, with some remarks on the formation of Dew. By G. Dines. [*Proceedings of Meteorological Society*, Nov. 1870.]

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