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THE CHRISTMAS FROST OF 1869.

ALTHOUGH by no means unusually severe in the vicinity of London, the frost of December 25th to 28th was sufficiently so in some parts to merit a passing notice.

In addition to the points to which attention is drawn in the following letters, we may specially note the very low temperatures at many places at and near the sea coast. Black Rock, Dublin, Haverfordwest, March Hill Cottage, Dumfries, Bridport, Wern, and Auchendrane, at all of which the temperature fell to or below 10° Fahrenheit are all either on or proximate to the sea coast.

Then there are the usual bewildering inconsistences, such as Clifton, where Mr. North, a most careful observer, reports a minimum of 25°·0, while all round him at Barnstaple, Westward Ho! (Northam), Haverfordwest, Sellack, and Bodmin, it ranged from 9° to 18°.

Then, again, we have in Dorsetshire, Bridport 10°0 and Weymouth 22°·8. And again, most puzzling of all, Llandudno 26°·3, while at Wern, near Port Madoc, it was 10°, Holker 13°, Haverfordwest 9°·0, and Dublin 8°.

Mr. Nutter, of Beech House, Cambridge, has favoured us with a statement of the minima on the morning of 29th, from five stations, all within a radius of one mile, viz., Cambridge Observatory, 19°; Mr. Payne's, 18°; Mr. Cuming's, 14°; Mr. Nutter's, 12°; and Mr. Chater's, 9°. Considering the proximity of the stations, and the flatness of the district, we would suggest that the thermometers should all be compared; possibly also variety of position, *i.e.*, mounting, may account for these differences; at any rate they merit examination.

To the Editor of the Meteorological Magazine.

SIR,—I enclose you the following low temperatures registered here last month:—

December 27th, at 9 p.m. (local time)	9°·0
December 28th, at 9 a.m. (local time)	6°·6

Lowest during night:—

At 4 feet from the ground	4°·9
On surface of snow	3°·0 below zero.

These readings are lower than any previously observed here during an uninterrupted period of eight years.—I am, yours, &c.,

H. DODGSON, F.M.S, &c.

Cockermouth, Jan. 10th, 1870.

To the Editor of the Meteorological Magazine.

SIR,—I enclose readings of maximum and minimum thermometers for part of this month, as showing rather, I consider, a curiously small range of temperature in 24 hours, and also a *rather* low reading on 28th (19°·5). Perhaps you may think it worth insertion in the *Meteorological Magazine*, for next month. The thermometers are both made by Pastorelli, verified quite lately, the one at Kew, and the other at Greenwich Observatory.—Yours truly, FRANCIS NUNES.

Heathfield Lodge, Chislehurst, Kent, Dec. 31, 1869.

Day.	Min. deg.	Max. deg.	Range in 24 hours. deg.
23	35·0	41·0	6·0
24	36·0	38·5	2·5
25	30·0	32·0	2·0
26	26·0	27·0	1·0
27	21·0	31·0	10·0
28	19·5	32·0	12·5
29	21·0	38·5	17·5
30	33·5	39·5	6·0

THE EXPERIMENTAL THERMOMETERS IN THE FROST.

To the Editor of the Meteorological Magazine.

SIR,—Many of your readers will probably be interested in the following short table. The readings are corrected for index error.—Yours truly, C. H. GRIFFITH.

Strathfield Turgiss Rectory, Winchfield, Jan. 1st. 1870.

Minimum temperature recorded at 9 a.m., of December 28th, 1869.

	deg.		deg.
James's Stand	16·3	Pastorelli's Stand	15·9
Lawson's, do.	15·0	Morris's, do.	19·8
Stow's, do.	16·4	Griffith's, do.	14·7
Martin's, do.	17·8	*Shrubbery, do.	17·6
Stevenson's, do.	17·2	Window, do.	21·0
Glaisher's, do.	16·9	Kew, do.	17·3

*[This stand has not yet been described; it is a Pastorelli stand, completely buried in thick shrubs, none of which are, however, allowed to *touch* the thermometer.]—ED.

MINIMUM TEMPERATURES IN SHADE, DECEMBER, 1869.

Temp. Fah.	Date	County.	Station.	Observer.
— 4·0	28	Westmoreland	Kirkby Lonsdale	W. Harrison, Esq.
+ 1·0	27	Aberdeen	Ballater	J. W. Paterson, Esq.
4·9	28	Cumberland	Cockermouth	Dr. Dodgson
6·0	28	Westmoreland	Casterton, Kirkby Lonsdale	S. Morris, Esq.
7·8	28	Worcester	Bromsgrove	G. Dipple, Esq.
8·0	27	Lanark	Cessnock Park	R. Hart, Esq.
,,	28	Dublin	Black Rock	T. Bewley, Esq.
9·0	28	Pembroke	Haverfordwest	E. P. Phillips, Esq.
,,	27	Perth	Deanston	J. Finlay, Esq.
9·5	28	Dumfries	March Hill Cottage	T. Hogg, Esq.
10·0	28	Dorset	Bridport	A. Stephens, Esq.
,,	28	Yorks	Arncliffe	Rev. W. Boyd.
,,	28	Northumberland	Whitfield	Rev. J. M. Mason.
,,	27	Carnarvon	Wern, Port Madoc	Major Mathew.
,,	28	Ayr	Auchendrane	E. Cathcart, Esq.
10·7	29	Worcester	Orleton	T. H. Davis, Esq.
11·9	28	Nottingham	Highfield House	E. J. Lowe, Esq., F.R.S.
12·0	28	Tyrone	Leckpatrick	Rev. C. Maxwell.
13·0	27	Kent	Bromley	Rev. A. Rawson.

Temp. Fah.	Date.	County.	Station.	Observer.
13·0	28	Lancashire	Holker	Mr. W. Wilson.
13·5	28	,, ...	Manchester	G. V. Vernon, Esq.
14·0	27	Leicester	Wigston	T. Burgess, Esq.
,,	28	Wilts	Wilbury	*The Times.*
14·5	28	Devon	Barnstaple	T. Mackrell, Esq.
,,	28	,, ...	Northam, Bideford.....	Rev. I. H. Gosset.
15·0	28	,, ...	Meshaw	Rev. W. H. Karslake.
,,	28	Suffolk.....	Culford..... ..	Mr. Grieve.
,,	28	Essex	Audley End	Mr. J. Bryan.
,,	28	Shropshire	Shiffnal.....	Rev. J. Brooke.
,,	27	Staffordshire ...	Barlastone	W. Scott, Esq.
,,	28	Derby	Derby	J. Davis, Esq.
,,	27	Cheshire	Macclesfield	W. Jeffery, Esq.
,,	29	Yorks	York.....	F. Thorp, Esq.
,,	27	Dublin.....	Monkstown	A. H. Pim, Esq.
,,	27	Down	Waringstown	Captain Waring.
16·0	29	Middlesex	Winchmore Hill	T. Paulin, Esq.
,,	28	Leicester	Leicester	H. Bilson, Esq.
,,	27	Argyll	Castle Toward	Mr. McIntosh.
,,	27	Queen's County	Portarlington	Dr. Hanlon.
,,	28	Sligo.....	Doo Castle	Mr. D. O'Dowd.
16·9	28	Hants	Strathfield Turgiss	Rev. C. H. Griffith.
17·0	29	Kent...	Linton Park.....	J. Robson, Esq.
,,	3	Lincoln	Killingholme	Rev. J. Byron.
,,	26	Yorks	Middlesboro'	W. Fallows, Esq.
17·4	28	Denbigh	Trevalyn Hall.....	Captain Griffith.
17·5	28	Hants	Selborne	T. Bell, Esq.
,,	28	Hereford	Sellack	Rev. W. C. Ley.
17·7	28	Lincoln	Boston	Dr. Adam.
17·8	2	Aberdeen..... ...	Aberdeen	Rev. A. Beverly.
18·0	26	Cambridge	Cambridge Observatory ...	Prof. Adams, F.R.S.
,,	26	Herts	Hitchin	W. Lucas, Esq.
,,	28	Cornwall	Bodmin	Capt. J. Liddell, R.N.
,,	27	Gloucester	Stroud	Miss Stanton.
,,	28	Warwick	Birmingham	T. L. Plant, Esq.
18·5	28	Berks	Lynnwood	Adm. Sir F. W. Grey.
,,	5,28	Yorks	Willow Hall	Louis J. Crossley, Esq.
18·7	28	Northumberland	N. Shields	R. Spence, Esq.
19·0	27	Cavan	Owendoon	G. H. L'Estrange, Esq.
19·5	28	Kent.....	Chislehurst	F. Nunes, Esq.
19·8	28	Hants	Wainsford	H. Fawcett, Esq.
20·5	27	,, ...	Newport, I. of Wight ...	E. G. Aldridge, Esq.
20·8	29	Middlesex	Camden Square	G. J. Symons, Esq.
21·3	28	Kent.....	Greenwich Observatory ...	J. Glaisher, Esq., F.R.S.
22·8	28	Dorset	Weymouth	E. Glyde, Esq.
23·7	27	Orkney.....	Sandwick.....	Rev. Dr. Clouston.
24·0	27	Galway.....	Queen's College	Prof. Curtis.
25·0	28	Cornwall	Penzance	W. H. Richards, Esq.
25·0	27	Gloucester	Clifton	A. North, Esq.
26·3	2	Denbigh	Llandudno	Dr. Nicol.
			MIN. ON GRASS.	
— 3·0	28	Cumberland ...	Cockermouth	Dr. Dodgson.
+ 6·5	28	Pembroke	Haverfordwest.....	E. P. Phillips, Esq.
9·0	28	Lincoln	Boston	Dr. A. M. Adam.
9·4	28	Notts	Highfield House	E. J. Lowe, Esq., F.R.S.
16·5	28	Aberdeen.....	Aberdeen	Rev. A. Beverley.
17·0	27	Flint	Llanerch	Whitehall Dod, Esq.
17·2	28	Middlesex	Camden Square	G. J. Symons, Esq.
18·7	28	Dorset	Weymouth	E. Glyde, Esq.
23·0	28	Gloucester	Clifton	A. North, Esq.

BEST TIME FOR READING THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—I should like to know from those who have studied the subject what hours are thought best for the reading of registering thermometers. Many, myself included, have been in the habit of reading both maximum and minimum thermometers at 9 a.m. The chief objection to this practice seems to be, that one warm day often furnishes maxima for two, and in winter one cold morning not unfrequently furnishes minima for two days.

If diurnal changes can justly be compared to waves, we should naturally measure the height between successive troughs, and the depth between successive crests. In other words, the maximum should be read at the hour of minimum temperature, and the minimum at that of greatest heat. This would obviate the above-mentioned objection in nearly every case. The objection to it of course would be that most observers are in bed at 3 a.m., and it must therefore be dismissed as impracticable. But might it not be an improvement on the present practice to read the minimum at 10 a.m. and the maximum at 10 p.m.? At any rate the subject might well be discussed.—Yours, &c.,

FENWICK W. STOW.

Hawsker, Whitby.

TRUE TIME.

To the Editor of the Meteorological Magazine.

SIR,—I read the article on this subject in your last number with much interest, and I hope some good may come of it.

There can be no doubt that the best means of obtaining correct time is by transit of the stars; but it seems to me that for the great majority of people, sidereal observations are out of the question. Apart from their cost, the instruments now in use require far too much nicety and care ever to become popular.

I think one of the simplest and most accurate instruments that we have is the meridian dial, and for those of your readers who have not seen one, I will give a short description of it. It consists of an upright plate, which has a very narrow vertical slit reaching to the bottom. This plate is fixed facing south, upon a smooth horizontal slab of iron or stone. At the time of solar noon the line of brightness is marked upon the slab, the exact time having been ascertained and carried by a good watch or chronometer from some trustworthy source. When once the plate is properly fixed, the line will always shew solar noon, and give correct time within a very few seconds.*

In using an instrument of this kind, allowance must of course be made for longitude, and for the equation of time. Supposing, for instance, that we have the plate fixed at Bristol, and wish to find Greenwich mean time by it on March 1st, 1870. Solar noon at Bristol occurs 10m. 12s. later than at Greenwich, and on the day mentioned we find from the almanack that the equation of time is + 12m. 32s.

* See Denison's Treatise on Clocks, &c., page 19.

When, therefore, the dial shews solar noon, Greenwich mean time will be 22m. 44s. past 12.

There is a simple method of regulating a clock by transit, as follows. If a thin plate with a small hole in it be set up facing south, and due S. of it there be fixed a perfectly vertical straight edge, the occultation of any given star against the straight edge will be seen through the hole exactly every 24 sidereal hours. Now the mean day is 3m. 55·7s. (mean) longer than the sidereal day: if then a clock keeping mean time be set by any star; after an interval, say of 10 days, it should be 39m. 17s. behind the star. If very great care is taken to fix the plate and straight edge exactly in the meridian, the apparatus might even be used for ascertaining correct time, by means of tables.

One word about clocks. I consider that more than half our troubles are due to the extraordinary want of enterprise and ambition on the part of our English clockmakers. It is a remarkable fact, that excepting the regulator, which is very costly, there is no kind of clock commonly made in England which can be depended upon to keep time within two or three minutes per week. Some clocks, however, have lately been brought to England from the Continent, which keep time uncommonly well, and are moderately cheap. They are commonly called German regulators. Some care is necessary in the choice of them. The train should be driven by a weight, not a spring, and the pendulum should have a wooden rod, with the bob consisting of a long cylinder of zinc or lead; the escapement of course should be dead. A clock of this kind, if carefully made, will keep time within about 10 seconds per week.

There are very few people who have not the means of occasionally obtaining the correct time, and if they have a clock which keeps time within a quarter of a minute per week, they will never be far wrong. I strongly recommend these clocks to your notice; their price varies from 4 to 7 or 8 guineas, according to finish, and the character of the case, &c.—I remain, Sir, yours truly,

A MEMBER OF THE BRITISH HOROLOGICAL INSTITUTE.

January, 1870.

To the Editor of the Meteorological Magazine.

SIR,—Your remarks in the December number of the magazine induce me to tell you my experiences in the determination of mean time, as I have for some time been striving to find out a cheap and accurate method.

An observation of the altitude of a heavenly body by means of a sextant and artificial horizon seems to be by far the best method. A good second-hand sextant may often be bought very cheap, and the labour of working out the observation is not very severe.

A dipleidoscope has lately been lent to me, and I find that an observation of a transit of the sun may be taken, subject to an error not greater than two seconds: a star, however, cannot be observed with any such accuracy. I have not had the opportunity of testing the accuracy with which the instrument is made—*i. e.*, whether when it

is adjusted for the transit of a body of small elevation, it would also be equally accurate for another body of much greater elevation. One great disadvantage is, that it can only be used for meridian observations, and these are often rendered impossible by passing clouds.

The cheapest and most easily constructed apparatus, which is at the same time accurate to a few seconds, that I have ever seen is the following :—A school slate is firmly fixed, approximately perpendicular to the plane of the meridian and inclined at a small angle (say 20°) to the horizon. A stoutish piece of zinc, about 14 in. long and 6 in. wide, is bent at about 5 inches from one end at an angle of about 40°. A very small hole has been previously bored in the shorter part of the zinc, about an inch from the bend; the zinc around this small hole for a radius of about a quarter of an inch should be gradually thinned as much as possible; the longer part of the zinc must now be firmly fixed in a vertical position to or near the slate: thus the shorter part of the zinc will be about parallel to the slate, and a small bright spot (the image of the sun) will be seen on the slate for some time before, at, and after, the meridian passage of the sun. Now take a fine needle and fasten to it as symmetrically as possible and near the point a good sized shot; pass a fine silk thread through the eye of the needle and through the small hole in the zinc plate; you have thus a plumb-line which will determine the point in the slate vertically below the hole in the zinc. Taking this point for the centre, with a pair of compasses describe about ten or twelve concentric circles on the slate. On some one day mark the points at which the bright spot crosses each circle before noon and again after noon; bisect the arc between each of these pairs of points, and join with the centre of the circles the mean point of bisection; this line will be the meridian line, and the transit of the sun across it may be observed within a very few (3 or 4) seconds. The position of the meridian line ought to be determined when the sun's declination is changing slowly.

This apparatus is far inferior to the dipleidoscope, since it is only available for solar observations, but it is very cheap (not costing more than a few shillings).

Another very simple method is to fasten a straight-edge accurately vertical against a wall which is nearly in the meridian, and to observe the transit of sun or stars seen through an eye-hole some 20 feet from the straight-edge; the position of the eye-hole might be fixed by observing the transit of a known star on some day when the observer's watch had been accurately set.—Yours truly,

J. M. DU PORT.

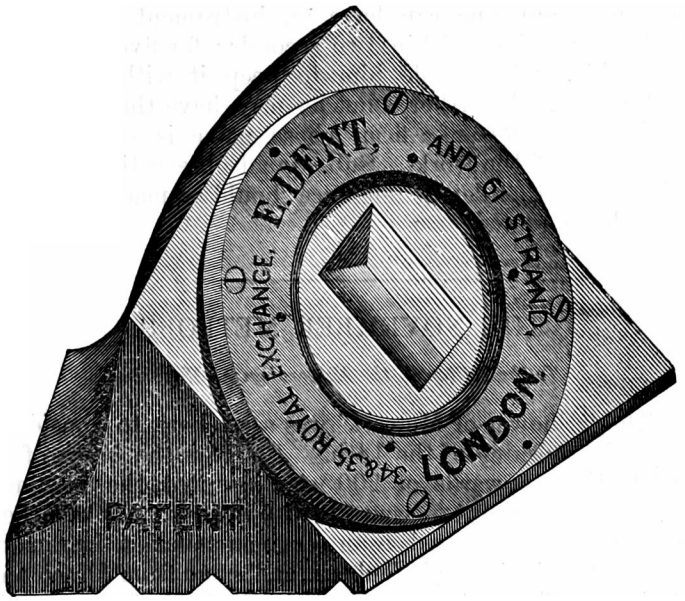
Mattishall, Jan. 8th, 1870.

DIPLEIDOSCOPES.

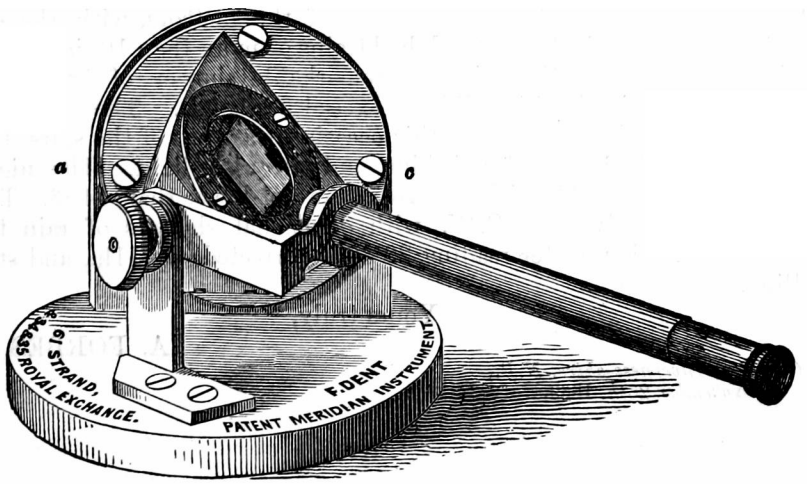
As probably many of our readers are not familiar with these instruments, we append a few details, for which we are indebted to a pamphlet by the patentees.*

* A description of the Dipleidoscope, by E. J. DENT, F.R.A.S.; 8th Edition, London: E. Dent & Co.,, 1867.

The name of the instrument truly indicates its principle, namely, observations of a double image, one being simple reflection from a plain glass surface, the other double reflection from two reflectors inside it. The instrument being once firmly fixed in the right position by a chronometer, by careful magnetic observations, or by Polaris, it will (in its simple form, costing £2 2s.) give time by the sun within two seconds, and is available for a considerable range of latitude.



The following engraving shows a very much improved form, whereby the line of vision is kept permanent, and the motion of the object observed is increased by the multiplying power of the telescope; in this form there seems little reason to doubt that it is little inferior to a small transit :—



Messrs. Dent add the following foot-note:—

"To any gentleman who may be disinclined to take the trouble of fixing the Dipleidoscope for himself, and who is desirous of securing the utmost possible accuracy, Mr. Dent will send a competent person, furnished with a chronometer, to fix the instrument, on payment of the actual travelling expenses, and a remuneration to the party of ten shillings per day."

We have, therefore, reached one stage of our inquiry, and find that for two guineas any one can have an instrument which will enable him to *keep* true time within two seconds; for five guineas he can have one which will enable him to keep it within a quarter of a second; for a small further sum he may have the instrument fixed for him by an *employé* of a firm whose name is sufficient guarantee for the accuracy of the work. Subsequent observations are extremely simple, but for further details reference should be made to the pamphlet whence we have quoted.

THE NOVEMBER METEORS.

To the Editor of the Meteorological Magazine.

SIR,—The "Shower of Meteors" was seen here to considerable advantage on the morning of the 14th. Between the hours of 3 and 7 (Greenwich time) upwards of 200 were counted, the maximum part of the shower appearing to occur about 5 o'clock. While the greater number of meteors emanated from the constellation Leo, many came from Perseus, Cassiopiea and Cepheus, and some from Draco and other constellations. The meteors generally shot forth from two to three together, at intervals of from 30 seconds to 45 seconds, their course being downwards, or towards the horizon, with the exception of one which came from Perseus. This meteor shot across the zenith from W.S.W. to E.N.E.—the nucleus, which was about the size of Jupiter, and intensely bright, bursting in two before it disappeared. The time of its occurrence was 4h. 48m. None of the meteors, with the exception of the one just described, had trains of more than 10° in length, and, different from those in the remarkable shower of 1866, the duration of their visibility did not exceed 5 seconds. The colour of the nucleus of the meteors on this occasion was that of the stars, but a few of them had hues of red, blue, and greenish light. The night of the 13th was mild, with a temperature not lower than 44°·3. The wind blew briskly from S.W., with occasional showers of rain till midnight, the barometer reading 29·364 (corrected) at 11h., and still falling.

Yours truly,

A. FORBES.

Culloden, Inverness-shire, N.B.,
November 26th, 1869.

THUNDERSTORM OF DECEMBER 15TH.

Early on Wednesday morning last another exemplification of the proverbial fickleness of the weather, was given by the unexpected and remarkable occurrence of a severe thunderstorm in York and neighbourhood. The weather on the previous day had been dull but mild for the season; and a clear, frosty moonlight evening was followed by a heavy storm of thunder, lightning, and rain. The first rumblings of thunder were heard about half-past one o'clock on Wednesday morning, occasional flashes of lightning being also seen. As the early hours of the morning wore on, the storm, which proceeded from the south, gradually increased in intensity, and was accompanied by a heavy downpour of rain. Between three and five o'clock the storm appeared to be at its height, remarkably vivid flashes of forked lightning following each other in rapid succession, and peal upon peal of terrific thunder disturbing the repose of the more wakeful inhabitants. After five o'clock the storm, which appeared to have made the circuit of the horizon, gradually subsided, but occasional flashes of lightning and reverberations of distant thunder were recognisable till half-past six. There was no material alteration in the temperature during the occurrence of the storm.

A correspondent at Easingwold, says:—On Wednesday morning last, a little before six o'clock, a violent storm of thunder and rain passed over this town. There were several vivid flashes of lightning, followed by loud peals of thunder, causing considerable alarm to most of the inhabitants. The wind was very boisterous at the time, which made the storm more terrific.

A Malton correspondent writes: between four and six o'clock on Wednesday morning, two violent thunderstorms occurred in this neighbourhood. Being very dark, the flashes of lightning were terribly grand. Several showers of hail fell, followed by extremely heavy rains. The rivers have been top full for a week back, and an overflow is now feared.

A later letter from Malton, says: from numerous quarters we hear of timber shattered by lightning, and also cases of stock killed in the fields. At Alncliffe-dale Head an ash tree was split in pieces, and a thatched shed beneath it was fired, and a mare and foal roasted. Mr. Gibb, the owner, had just fed the mare, and had not left more than three or four minutes Owing to the fury of the storm, and the incessant blaze of lightning, all effort to save the animals was useless. On Lyulph Common more than twenty sheep were killed, and the furze was set on fire, but put out by the rain. Windows were broken by the hailstones—or rather angular lumps of ice—and in various places streets were like rivers, and houses flooded. The North Riding rivers have risen rapidly, and there is every appearance of an overflow.

From Filey we learn that the storm broke over that neighbourhood about seven o'clock in the morning. The rain fell in torrents, accompanied by peals of thunder and terrific lightning. A large wind-

mill upon the hill, a short distance from Hunmanby Station, occupied by Mr. Plewes, was struck by lightning; the electric fluid entering a crevice at the top of the mill and running down a chain, which fortunately acted as a conductor, entered the ground without doing any injury to the mill, but the links of the chain were welded together into one mass.

At Ripon, about a quarter-past five, a terrific storm of thunder, lightning, sleet, hail, and wind passed over the city. The lightning struck the house of Mr. W. Abbott, of the Old Market-place, but the inmates escaped without injury. The damage done to the premises was slight. The storm raged about half-an-hour.

At Winestead, near Hull, three horses were killed and the man in charge of them was injured by the lightning. The young man (Norgraves), foreman on the farm Mr. T. G. Dunn, of Winestead, had three horses yoked to a cart for the purpose of leading turnips, and he having obtained a load of turnips was proceeding towards Mr. Dunn's farm with it, when about half-a-mile from it a vivid flash of lightning struck the horses, knocking them down, and striking Norgraves with great force, completely shattering one of his boots, tearing it off his foot, and hurling it a considerable distance. A watch-guard which Norgraves was wearing at the time was broken in pieces, and the face of his watch was also shattered. Norgraves, although stunned, was able to shout to some workmen a few hundred yards off, and they at once hastened to see what had occurred, when they found that the three horses were dead, and that the man had been injured. Norgraves was at once conveyed to Mr. Dunn's, and medical assistance obtained; his injuries were found to be wholly external, and hopes were entertained of his speedy recovery. The horses were worth about £80, which is nearly covered by insurance.—Another accident from lightning occurred at Winestead, about the same time as the above, but in this case no one was injured. The lightning struck the gas piping fixed to Mr. Marshall's flax mill, causing it to burst and the gas to ignite, but the gas was turned off at the main pipe, and no serious damage was done. Had it occurred when the hands were off work the damage would probably have been very serious.

In the East Riding the storm seems to have followed the wolds, several reports of damage coming from the western slopes. In Holderness—the flat country between the wolds and the sea—the storm was severe.

The metropolis and suburbs were also visited shortly before daylight on Wednesday morning with a hailstorm of extraordinary severity. A violent gale blew during the early part of the night; this was followed by a very heavy fall of rain, and between six and seven o'clock a burst of hail took place which lasted for some minutes. The roads in the south-western suburbs were torn up as they sometimes are after a severe thunderstorm in summer. Such a tempest at this season of the year is very rare.

The Bristol papers report a heavy thunderstorm in that city.

REVIEWS.

Tyneside Naturalists' Report, 1868. [Second Notice.]

(*Continued from page* 92.)

OUR previous notice, and the letters arising therefrom, have occupied so much space that we are reluctantly obliged to abandon our intention of examining in the detail which the excellence of the publication merits, the residue of its contents. Since our September number appeared, we have received from the observer at Greta Bridge the necessary data for completing the table (on p. 123) in that number. He states that the fall really was in January 3·21, April 3·29, May 1·01; therefore, the yearly total is wrong, both in the *Tyneside Report* (28·81), and in *British Rainfall* (28·69), the real amount being 28·79. We sincerely hope that all those of our readers who are also observers will accept as a warning the trouble and discredit errors of this class bring upon those who of necessity must rely to some extent upon the carefulness of their correspondents.

We notice similar anomalies in the barometrical returns; most of them agree very well, and from them and other sources we know that the difference between the mean reading of the barometer at stations in the North of England in November and December, 1868, was 0·61 in. but we find from the tables that at Alston it was 0·74 in., and at Wallington, 0·06 in. Very probably some entries have been made an inch too high in December, but if meteorology is to make any progress errors of this sort must be hunted down, however unpleasant the process to all parties—most of all to those whose duty it is to point them out. The wind records have been tabulated in a very useful manner by Dr. Hooppell, who draws attention to some want of uniformity in the observers, and suggests improvements for 1869.

Sur le Régime Pluvial du Bassin Occidental de la Méditerranée. Par V. RAULIN. 8vo, 8 pages. [Extrait des Actes de l'Academie des Sciences de Bordeaux, 1867.]

THIS paper is so brief, so much to the point, and to English readers difficult to obtain, that instead of reviewing it we shall freely translate it, inserting any remarks of our own between square brackets [ ].

In my "Observations Pluviométriques faites dans le Sud-Ouest de la France, de 1714 à 1860," I said, speaking of the constancy of the three-monthly and monthly curves, that "if for rainfall observations a period of ten years is quite insufficient when we endeavour to determine the mean fall over a country, ten years, provided they are consecutive, or taken hap-hazard from a long series will suffice to give a fair idea of the relative fall in different seasons of the year, and fix approximately the course of the monthly curve belonging to the locality, such as in the Aquitaine in the zone of autumn rains, or in the central

districts, and the Pyrenees in the zone of spring rains. In fact, in "two localities where two series of continuous observations of nearly half-a-century have been made—namely, at Courçon (Charente Inférieure), where the autumn rains predominate, and Toulouse, where the vernal ones are heavier, two periods (one of the ten wettest years and one of the ten driest years) give the means and seasonal curves almost identical with those of the 50 year values."

It appears to me of high interest to ascertain the distribution over the French shores of the Mediterranean, and indeed over the whole area from Spain on the west to Italy on the east, France on the north, to Tunis and Algeria on the south.

Even up to 1840, the series of observations necessary for this study existed only for the centre of France, for Italy, and Gibraltar. In 1850 we had besides, three Algerian stations. In 1867 we further obtained a series from Corsica, three from Spain, and one from Portugal.

The series of which I shall make use contains at least the twelve years 1856—67.

Even the most superficial examination of the monthly amounts shows that the district I have named, possesses a rainfall region distinguished by drought during the three summer months, which is slight in Northern Italy, but severe in France and Southern Italy, and extremely so in Corsica, the Balearic Isles, Sicily, Algeria, Spain, and Southern Portugal.

In Spain, on the coast at Alicant, as in the high plateau of Madrid, and in Roussillon, at Perpignan, the winter is exceptionally dry, spring and autumn are the most rainy seasons, and they are nearly equally so.* On all the rest of the coast autumn and winter are always the two most rainy seasons, but there are great differences in the relations which exist between them. In France, at Montpelier, Marseilles, and Toulon; on the south-west coast of Italy, at Gênes, Pisa, and Rome, autumn is much more rainy than winter. In Corsica, at Ajaccio, and in the Balearic Isles, at Palma, autumn slightly exceeds winter. A series at Cagliari, in Sardinia, would be very interesting.

In Northern Italy, at Naples, Molfetta, Locorotondo; in Sicily, at Nicolosi and Palermo winter and autumn are nearly alike. In Algeria, Southern Spain, and at Lisbon, winter rains far exceed those of summer.

(*To be continued.*)

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* Since writing the above, I have received from Monsieur José Monserrat at Valencia (Spain) a series of eleven years, which form a remarkable anomaly. Contrary to what occurs in the three localities just named, and one may almost say at Palma, the autumn rains at Valencia, in the interior of the trapezium, far exceed those of winter and spring. It will be very important to know what occurs at Barcelona, but M. Antonio Rave has not yet sent the observations for which I have asked him.

DECEMBER, 1869.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of nights below 33° on grass
			inches	inches.	in.							
I.	ENGLAND.	Camden Town	2·94	+ 1·44	·65	16	14	57·7	19	20·8	29	11
II.		Staplehurst (Linton Park)	3·79	+ 1·96	·84	21	21	52·0	18	17·0	29	16
,,		Selborne (The Wakes)	4·72	+ 1·97	·98	16	15	52·3	18	17·5	28	17
III.		Hitchen	3·27	+ 1·96	·56	16	21	57·0	18	18·0	26	10
,,		Banbury	4·29	+ 2·62	·89	16	21	54·0	18	16·0	28	17
IV.		Bury St. Edmunds (Culford)	4·84	+ 3·35	·64	16	21	54·0	18	15·0	28	8
V.		Bridport	4·37	+ 1·00	·72	16	17	54·0	17‡	10·0	28	13
,,		Barnstaple	5·19	+ 2·07	·83	17	18	57·0	18	14·5	28	...
,,		Bodmin	5·68	+ ·44	·85	16	23	52·0	8	18·0	27§	10
VI.		Cirencester	5·30	+ 3·01	1·40	16	16	...	...	...	...	...
,,		Shifnall (Haughton Hall)	3·31	+ 1·63	·60	14	19	55·0	18	15·0	28†	17
,,		Tenbury (Orleton)	4·45	+ 1·99	·62	18	21	58·0	18	10·7	29	13
VII.		Leicester (Wigston)	3·58	+ 2·06	·57	17	14	55·0	18	14·0	27	11
,,		Boston	4·44	+ 2·95	·64	17	26	55·8	18	17·7	28	9
,,		Grimsby (Killingholme)	4·72	..	·58	17*	27	55·0	18	17·0	3	...
,,		Derby	3·91	+ 2·36	·88	17	21	55·0	18	15 0	28	13
VIII.		Manchester	3·62	+ 1·29	·86	17	20	55·0	18	13·5	28	12
IX.		York	3·66	+ 1·86	·58	5	22	56·0	16	15·0	29	13
,,		Skipton (Arncliffe)	8·12	+ 3·57	2·08	18	13	51·0	19	10·0	28	17
X.		North Shields	2·81	+ ·61	·51	26	23	56·0	18	18·7	28	11
,,		Borrowdale (Seathwaite)	17·77	+ ·82	3·87	11	16	...	...	...	...	...
XI.	WALES.	Cardiff (Town Hall)	5·55	...	1·40	16	14	...	...	...	...	...
,,		Haverfordwest	5·94	+ 1·11	1·32	16	14	54·0	18	9·0	28	14
,,		Rhayader (Cefnfaes)	7·39	+ 4·10	1·72	17	12	53·0	...	13·0	28	5
,,		Llandudno	3·07	+ ·87	·67	17	16	56·6	18	26·3	2	7
XII.	SCOTLAND.	Dumfries	4·49	+ 1·03	·65	13	12	54·0	18	9·5	28	17
,,		Hawick (Silverbut Hall)	3·62	...	·69	10	16	...	...	...	...	...
XIV.		Ayr (Auchendrane House)	6·80	+ 2·78	2·36	10	19	61·0	13	10·0	28	23
XV.		Castle Toward	6·16	+ ·81	1·01	10	15	52·0	13	16·0	27	17
XVI.		Leven (Nookton)	1·58	— 1·20	·43	10	13	...	..	...	...	...
,,		Stirling (Deanston)	5·26	+ 1·06	1·08	10	19	51·1	18	9·0	27	25
,,		Logierait	3·42	...	·67	30	14	...	...	...	...	..
XVII.		Ballater	2·78	...	·53	30	16	49·0	18	1·0	27	26
,,		Aberdeen	2·81	...	·71	30	20	48·2	13	17·8	2	27
XVIII		Inverness (Culloden)	2·67	...	..	.	...	47·9	18	21·0	27	17
,,		Fort William	...	...	...	...	...	...	...	...	..	...
,,		Portree	10·64	— 4·99	1·28	13†	20	...	...	...	...	...
,,		Loch Broom	5·63	...	·68	14	16	...	...	...	...	...
XIX.		Helmsdale	2·71	...	·42	14	23	...	...	...	...	...
,,		Sandwick	3·76	— ·21	·92	30	21	45·0	14‡	23·7	27	9
XX.	IRELAND.	Cork	7·12	...	1·88	29	18	...	...	...	...	...
,,		Waterford	5·41	+ ·99	·69	16	21	50·0	12	19·0	27	14
,,		Killaloe	6·19	+ 2·68	·93	17	19	55·0	18	18·0	28	12
XXI.		Portarlington	3·39	+ ·19	·49	18	28	56·0	18	16·0	27	15
,,		Monkstown	3·14	+ ·52	·55	30	16	47·0	1	15·0	27	...
XXII.		Galway	8·07	...	1·35	29	25	51·0	1	24·0	27	9
,,		Bunninadden (Doo Castle)	6·19	...	1·27	30	21	53·0	18	16·0	28	11
XXIII		Bawnboy (Owendoon)	6·06	...	1·00	17	19	54·0	17‡	19·0	27	18
,,		Waringstown	3·37	...	·48	10	19	56·0	18	15·0	27	18
,,		Strabane (Leckpatrick)	6·55	..	·92	29	23	54·0	18	12·0	28	28

* And 21. † And 29. ‡ And 18. § And 28.

+ 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; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

STAPLEHURST.—First week cold and frosty; middle of month mild and wet, with floods on 17th and 22nd; last week frosty, with a considerable quantity of S on the ground; high winds on nights of 13th, 15th, and 17th; fogs prevalent in the middle of the month.

SELBORNE.—A little S at noon on 3rd, heavy fall on following day; fog on 7th, 8th, 9th, and 10th; wind changed from N. and E. to S. 11th; white frost on 12th; violent H storm with T, R, and wind from W. at 6 a.m., 1 p.m., and 4 p.m. on 15th; hurricane all night of 16th and morning of 17th.

HITCHEN.—S on 24th, 25th, 26th, and 27th.

BANBURY.—H, T, L, and R on night of 14th and morning of 15th. S on 1st, 21st, 24th, 25th, 26th, and 27th.

CULFORD.—A month of great rainfall being more than three times the average; S on the 1st and 3rd; Christmas morning was ushered in by a S storm, and S continued at intervals during the next three days.

BRIDPORT.—On the 16th, 0·72 in. fell in ten hours; L on 9th, 15th, and 19th; gales on 13th, 14th, 15th, 16th, 19th, and 30th; bar. at 29·10 at 6 p.m. on 16th. Sea very rough on 30th; a brig came on shore at 7 p.m., and soon went to pieces.

BODMIN.—Average temp. of the month 40°·0, being 3°·4 below the average.

CIRENCESTER.—An extraordinary fall of R on the 12 days—10th to 21st, and on the 16th R equal in bulk to that from a July T S, more than ·20 an hour, total fall being 1·40; T six miles E. of Cirencester was heard on that occasion, and the R was succeeded by a gale of wind commencing at 5.30 p.m., very violent at 7.30 p.m. On Christmas Eve real winter began, lasting only five days; temp. 20° on two nights.

SHIFNAL.—A most variable month, the changes from heat to cold were very sudden; hard frosts on the first five days; the ground was saturated with the continuous rainy days from the 8th to 22nd, inclusive, and there was such a flood as has not been known in this century, it is said, exceeding that of 1852; the water nine inches deep in the old Abbey Church. Hard frosts again from 25th to 29th, inclusive; fog or mist from 3rd to 10th.

ORLETON.—Cold and frosty to the 3rd, then a dense canopy of clouds till the 10th; heavy falls of R and S afterwards till the 23rd; great floods in the Severn on 21st; cloudy after, with severe frost at times till the end; L on evening of 15th; T on the 19th. Temp. about 3°·0 below the average; very variable, and subject to frequent and sudden changes.

WIGSTON.—Mean temp. 6°·5 below that of last December; rainfall above the average, although an inch and a half less than in December, 1868.

BOSTON.—The month began with frost, but thaw came on the 3rd, and the weather was wet and misty up to the 12th, when the falling mercury slightly rallied; the bar. was very steady for a few days, and on the 16th it fell as low as 28·768; this great depression was followed by a severe gale. On Christmas Day a frost of considerable intensity set in, and S fell heavily; thaw set in on the 29th, and the last two days of the old year were wet and gloomy. Ther. on grass went down to 9° on 28th.

KILLINGHOLME.—Three inches of S on 2nd, nearly all gone next day; sea gulls inland on 11th; brilliant meteor in N. at 6.15 p.m. on 12th. Bar. 29·00, and low tide at high water in Humber on 13th; lunar corona on 14th; T S between 7 and 8 a.m. on 15th, followed by H. Sea roaring at night from 21st to 26th, inclusive, very loud on 25th. Very wet wintry month throughout.

DERBY.—A cold wet month; ther. fell to 15°·0 on 28th-29th; 2·40 in. of R fell from the 13th to 18th, causing a very serious flood in the low-lying districts of the town; S 5 in. deep on the 27th, yielding 0·26 in. of water. It is much to be regretted that the custom is extending of speaking of low temperatures as so many *degrees of frost*, which is not only unscientific, but is the cause of many

errors. There are sufficient annoying discrepancies already in meteorological records without importing this.

ARNCLIFFE.—3·20 in. of R fell on the 17th and 18th, causing, on the latter day, the highest flood for 40 years; temp. rose from 11° on the 29th to 35° on the 30th.

NORTH SHIELDS.—S on 1st, 3rd, 24th, 25th, and 26th; T S on 23rd and 26th.

SEATHWAITE.—Though nearly 4·00 in. fell on the 11th, the total fall in the month was only ·82 above the average.

WALES.

HAVERFORDWEST.—A most variable month; first fortnight cold and frosty, with a slight fall of S, this was followed by a very wet and stormy period till the 22nd, after that frosty with S; intense frost from 25th to 28th; ther. on S on morning of 28th, at 8 a.m., reading 6°·5; on the following morning all trace of the recent severity disappeared as suddenly as it came; tremendous gales on 16th and 30th, with heavy rainfall.

CEFNFAES.—This month has been generally damp, heavy rains, H storms, T, L, and boisterous winds. On the morning of the 28th a ther. having an eastern aspect, but slightly shaded, at a quarter past nine stood at 13°.

LLANDUDNO.—S on the near or distant hills every day in the month.

SCOTLAND.

DUMFRIES.—The first nine days frosty and fine, from 10th to 19th wet and stormy, with occasional S showers; 20th to 28th frosty, with a heavy fall of S on the 26th, on morning of 28th the protected ther. being at 9°·5. The month closed wet and stormy. The frost has not been so intense since January, 1861.

HAWICK.—Skating and curling went on merrily for the first four days of the month, and although there were some pretty sharp frosts afterwards, it was not until the 21st that these invigorating sports were resumed for a few days. Stormy winds on 13th, 18th, 25th, 26th, 29th and 30th. The weather during the month has been very changeable. Brilliant meteor at half-past six p.m. on Sunday, the 12th, going in a westerly direction. I was in church at the time, or should have liked to have traced its course.—[We presume this is the same meteor as seen at Killingholme and Huddersfield at 6.15 p.m., though there is a difference of a quarter of an hour in the time mentioned.—ED.]

AUCHENDRANE.—The rainfall this December has been excessive, considering that the mean temp. was very low, and the bar. rather above the mean. The well-marked presence, however, of the polar and equatorial currents, with their attendant great fluctuations of heat and cold, may explain both the large rainfall, those wide oscillations of bar. and ther., and those calms and tempests for which this December has been remarkable. The heaviest gales here were on the 13th and 30th. The S on the 26th and 27th only measured 4 in. The river has been in constant flood.

CASTLE TOWARD.—The first 8 days clear and frosty; then wet and stormy until the 20th; fog and heavy white frost to the 22nd; then clear with intense frost to the 28th, when it changed suddenly to wet; strong gale on the 30th, with reports of losses on the Clyde; fog so close on the 20th that steamers on the Clyde could not go between Greenock and Glasgow. I have just taken up a common garden ther., that has been buried 8 inches in the centre of the garden; it stands at 41°, at this time last year it stood at 46°.

DEANSTON.—This month set in with sharp frost and sunshine; then some days dull and foggy; on the 10th stormy and wet, with heavy R on the 11th; gale on the 13th, wet and slight S showers, but none lay on low ground. Hard frost on 21st to 25th, with bright sun. Heavy blast of S on the 26th, lying two inches deep. Very hard frost on 27th and 28th; ther. at 9° during 12 hours from 9 p.m. on 27th to 9 a.m. on 28th; a little S on the night of the 28th; slight thaw on 29th; fresh S almost off all the low ground on the 30th; very stormy all day, with cold sleety R; wind S.S.W., with a swift upper current, accompanied by a loud rolling noise, which I think indicated a storm on the coast; blowing hard in the evening; 31st more settled, cloudy with some sunshine and light showers.

LOGIERAIT.—The frost which set in towards the end of November continued

without much intermission till the 28th December. From the 10th to the 18th there were several heavy falls of R, but there was always a degree of frost, while from that date till the 28th its intensity was very great. A strong gale on the 13th. Altogether it has been the most severe December we have had for many years.

BALLATER.—A very cold disagreeable month, with occasional intense frosts; the mean temp. 5° under that of December during the past 6 years; the rainfall under the average of the last 9 years.

ABERDEEN.—A month of cold unsettled weather; intense cold during the firs three days of the month, and again between 24th and 29th; severe S storm during the latter period; 19 nights on which auroræ were seen. Min. bar. 28·230 on 13th, on which day there was a heavy gale from the S. Bar., temp., R, and estimated pressure of wind, all under the average.

LOCHBROOM.—The month continued frosty from the 1st to the 9th; then unbroken R, S, H, sleet and wind to the 21st; then a week of very severe frost; and then we had four days of beautiful thaw, which ushered in as fine a new year's day and two following as we ever had.

SANDWICK.—December has been drier than the mean of the previous 28 years. The first part was particularly dry, and nearly half the R of the month fell in the last three days. On the 13th, at 9 p.m., the bar. fell to 28·096 in., which is the lowest since 8th of April, 1860, when it was 28·090, yet there were no violent storms here. There was some S with severe frost from 25th to 29th. Auroræ on four nights.

IRELAND.

GALWAY.—Severe storm at night on 13th, and also on 14th, with T and L.

DOO CASTLE.—Much R this month. T on the 13th, and a fierce gale, which lasted for one hour, from 3 to 4 p.m.; a gale also on the morning of the 30th. Some severe frosts; ther. down to 16° on the 28th. It was a month of extremes, heavy rains and severe frosts; the S covered the ground from the 25th to the 29th.

OWENDOON.—Great aurora on 13th, and high storm on morning of 30th.

WARINGSTOWN.—Heavy gales on the 10th, 13th, 19th, and 30th; that of the 30th was unusually violent. Sharp frosts during the fourth week. Rainfall above the average.

LECKPATRICK.—The wettest and coldest December registered here; about one-third of the whole rainfall of the year fell in the last two months; number of nights' frost on grass in the last three manths, 56, the grass ther. falling to or below 32° on every night in December. Mean temp. of month, 34·15. Severe gale on night of 30th.

METEOR OF DECEMBER 12TH.

To the Editor of the Meteorological Magazine.

SIR,—I send you the following, as written out for me by the spectators:—

"On the evening of December 12th, about 6.15, as we were descending the hill towards Huddersfield, and about two miles therefrom, we were suddenly surprised and delighted by one of the most brilliant meteors we had ever seen. Its course was north to north-west. It was yellow at first, rapidly changing into pale green. There were three bursts of light, and we fancied they were accompanied by a hissing sound. It lasted, we thought, about three seconds, the tail being visible a second or two later, and my sister insists it was crimson, though I did not notice that interesting fact.

H. B. C.

Fartown, Huddersfield.